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ABSTRACT

Included in this fourth annual yearbook are position papers, "how we do it" articles, research reports, and book reviews. The first four articles present information about the use of various technologies in instructional programs, i.e., computer assisted instruction at a college of advanced education, educational technology concepts and hardware to individualize external studies programs, video recording in teacher training programs, and three-dimensional instructional models. The fifth describes a new approach to the reviewing, recording, and locating of curriculum materials in both print and non-print formats. Article six looks at the potential advantages which technology offers to higher education, while seven points out some common criticisms of educational technology and offers some refutation of these criticisms. The final two articles focus on research and theory in educational technology--specifically in the area of instructional development and design. The book review section, new to the yearbook this year, provides reviews of four recent publications related to educational technology. (Author/LLS)

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ASET

AUSTRALIAN SOCIETY OF EDUCATIONAL TECHNOLOGY

ED194059

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# YEAR BOOK

## Volume 4 1979

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Lynna J. Ausburn
*Education Services Co-ordinator*
*Swinburne Technical College*

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Robert A. Cannon

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Keith Anderson - *Swinburne College of Technology*
Glen Garden - *Education Department of Victoria*
John G. Hedberg - *University of Melbourne*
Jean Anne Lescohier - *Salisbury College of Advanced Education*

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# CALL FOR 1980 YEARBOOK ARTICLES

The Australian Society of Educational Technology invites the submission of articles for consideration for publication in its 1980 Yearbook. Papers on all aspects of technology in education are welcome.

Intending authors should contact the Editor of the 1980 volume of the Yearbook for further information:

Mr. G. A. (Don) Shearer
6 Rahnston Court
Vermont, Victoria. 3133
Australia

NOTE: Submissions will be due with the Editor by June 1, 1980.

# EDITORIAL

This volume of the ASET Yearbook marks its fourth year of publication. The first three volumes were produced under the guidance of the foundation editor, Dr. Robert Cannon of the University of Adelaide. To Dr. Cannon the Society and the present editorial staff owe thanks for the establishment of the Yearbook as a valuable professional resource in educational technology, and for his continued interest in its development.

The editor's thanks are extended to all who contributed articles, reviews and reports to this volume, to those who served as members of the Editorial Panel, and to the staff of Dandenong College of TAFE for lending their facilities and expertise to the printing of the Yearbook.

The items in the 1979 Yearbook represent a wide variety of content including position papers, "how we do it" articles, reporting of research, and book reviews. Also represented are authors from a variety of locations: three Australian states and the United States.

The nine articles in the Yearbook offer readers many ideas, techniques, and viewpoints related to educational technology. The first four articles present information about the use of various technologies in instructional programmes. The article by Anderson opens the Yearbook on a timely note with a discussion of the computer-assisted instruction (CAI) system operating at a college of advanced education. He presents a discription of a CAI tutorial system, and some information about how students have reacted to its use. In the next two articles, Clinch illustrates how both concepts and hardware of educational technology can be utilised to individualise and personalise external studies programmes, and Hollander looks at the use of video recording in teacher training programmes. The article by Latz focuses on three-dimensional instructional models. After a brief discussion of the role of models in learning, he presents detailed information on using polystyrene as a model material and on constructing simple polystyrene cutting equipment.

The article by Carroll and Roe describes a most interesting new approach to the reviewing, recording, and locating of curriculum materials in both print and non-print formats. The approach they have developed entails the use of descriptors and a computerised data-base similar to other on-line information systems currently operating.

The two articles by Meyers and by Ausburn and Ausburn examine philosophical issues relating to positive and negative viewpoints of educational technology. The Meyers article looks at the potential advantages which technology offers to higher education, at levels of actual usage, at reasons for lack of usage, and at conditions for optimising usage. Ausburn and Ausburn point out some common criticisms of educational technology and offer some refutation of these criticisms.

The final two articles focus on research and theory in educational technology - specifically in the area of instructional development and design. Hedberg reports the findings of an investigation of factors considered by Australian and American academics to be significant contributors to the success of instructional development projects. Ragan closes the Yearbook by presenting a more general theoretical paper which directs readers' thoughts to the area of relationships between human characteristics and learning He offers an approach to analysing learner characteristics as they relate to instructional design.

The book review section, new to the Yearbook this year, contains reviews of four recent publications related to educational technology. These include Fleming and Levie's well-received *Instructional Message Design*, Williams' handy little *Television Production*, the American AECT's landmark *Educational Technology: Definitions and Glossary of Terms*, and Wittich and Schuller's new edition of their well-known *Instructional Technology: It's Nature and Use*.

At the end of its fourth year, the Australian Society of Educational Technology appears to be a growing contributor to the professional development of educational technologists throughout the country. The 1979 Yearbook of the Society reflects this contribution in the many activities outlined in its National and State Chapter Reports, and in the diversity of professional concerns addressed by its contributing authors.

## NATIONAL REPORT

### NATIONAL EXECUTIVE FOR 1979

NATIONAL PRESIDENT: Mr. A. C. Millar
*State College of Victoria at Toorak*

NATIONAL SECRETARY: Mr. W. Linklater
*Swinburne College of Technology*

NATIONAL TREASURER: Mr. D. H. Harrison
*Dandenong College of Technical and Further Education*

### NATIONAL REPORT

*Alex C. Millar*
*National President*

On my return from overseas in August of this year, I found that I had become the occupant of the position of National President of the Society. The advent of a non-South Australian to this position is an appropriate time to acknowledge the work of Deane Hutton and a small group of people in Adelaide who established the Australian Society of Educational Technology in 1975. As well as initiating this organisation, the South Australians launched the A.S.E.T. Yearbook, under the editorship of Bob Cannon. Altogether, the foundations were laid for an organisation which was to become a truly national body during the period 1977-78 when the Victorian, New South Wales and Queensland chapters were inaugurated. This growth was triggered by the Adelaide group amending the A.S.E.T. constitution early in 1977 to enable the establishing of a National Constitution with provision for state chapters, the first of which was to be South Australia. While we can be pleased that A.S.E.T. has developed as it has, there are still two states and the two territories where A.S.E.T. does not exist. It is our intention to determine whether a need exists in these other parts of Australia, and to facilitate the establishing of chapters whould circumstances warrant and permit.

Over the long weekend of October 6-9, 1978, the South Australian Chapter and National Executive hosted a Leadership Conference at a conference centre in the Adelaide hills. Representatives from three chapters gathered to focus attention on the theme of Visual Literacy and to informally map out lines and areas of operation for A.S.E.T. as a national body. This small but productive gathering proved to be a great success and will no doubt be attempted again in the future.

International contacts and experiences are invaluable professionally for individuals, institutions and organisations. A.S.E.T. acknowledges this and will be endeavouring to facilitate such communication. For example, the National Council has begun to engage in international dialogue with its professional counterparts in the United States, Canada and Britain. It is too early to guage what the final outcomes of these communications will be, but informal reactions have been most favourable. At the annual convention of the Association for Educational Communications and Technology held in New Orleans in March, 1979, four members of the Victorian Chapter were in attendance. In April, I was fortunate to be able to attend the annual conference in Sheffield of the Association for Educational and Training Technology, which was formerly known as A.P.L.E.T. Both conferences proved to be valuable professional experiences and gave us ideas and contacts which will be useful in the planning of the A.S.E.T. National Conference to be held in Melbourne on May 1st and 2nd, 1980.

The 1979 Yearbook has been edited by Dr. Lynna Ausburn, and we are grateful to her for taking over from Bob Cannon, who can how enjoy a well-earned relief from this work.

The National Council and its Executive are aware of the need to strengthen and diversify the organisation and activities of A.S.E.T. For a comparatively small organisation operating in a country the geographical size of Australia, this is not an easy task. However, by arranging meetings to coincide with significant interstate conferences, and by using the technology of Telecom, National Council meetings are being held, and progress is continuing. It is to be hoped that A.S.E.T. will develop further to provide for the professional needs of those in this field at the local, national and inter-national levels.

## NEW SOUTH WALES CHAPTER REPORT

### CHAPTER ADDRESS

The Secretary
c/- P.O. Box 126
NORTH RYDE. New South Wales. 2113

### NEW SOUTH WALES STATE EXECUTIVE FOR 1979

| | |
|---|---|
| PRESIDENT: | Mr. Maxwell C. Ward<br>*Cumberland College of Health Sciences* |
| SECRETARY: | Mrs. Robin Bishop<br>*Australian Film & Television School* |
| TREASURER: | Miss Lesley Muir<br>*Sydney Teachers College* |
| COUNCIL MEMBERS: | Miss Tricia Alexander<br>*Sydney Teachers College* |
| | Mr. Ian Brewer<br>*Mitchell College of Advanced Education* |
| | Miss Caroline Davy<br>*Alexander Mackie College of Advanced Education* |
| | Mr. Andrew Greig<br>*New South Wales Institute of Technology* |
| | Miss Rosemary Moon<br>*New South Wales Institute of Technology* |
| | Dr. Blair Stone<br>*Macquarie University* |

### NEW SOUTH WALES CHAPTER REPORT

*Maxwell Ward*
*Chapter President*

The First Annual General Meeting elected the Foundation Council consisting of John Angus, Robin Bishop, Ian Brewer, Andrew Greig, Ken Hardy, Lesley Muir, Blair Stone, Maxwell Ward and Ken Willoughby.

The Technical Committee was very active this year in arranging two technical days with about 59 persons attending. Topics included in these sessions were:

- colour video machines
- micro computers
- FM radio
- character generators
- editors and videos
- programmed maintenance



A technical tour of the Opera House allowed members to see behind the scenes into such things as audio control rooms, light consoles, and staging, and was so successful that a further tour is to be planned.

Prior to the Annual General Meeting, a H.E.L.P.S. screening day was held, allowing those institutions to show new programmes that would be available for rent, sale or loan.

Planning had started on A.S.E.T. being involved with EDUCARE 1979 in Sydney.

Blair Stone (C.A.T., Macquarie University) presented a talk entitled "A Clinic to Improve Teaching," which was very well received by those attending. It is hoped that more of these types of activities will be forthcoming in 1979.

I would like to express my appreciation for the support of the Foundation Council members and the untiring work of our Secretary, Robin Bishop.

## QUEENSLAND CHAPTER REPORT

### CHAPTER ADDRESS

Audio-Visual Services Department
Mount Gravatt College of Advanced Education
P.O. Box 82
MOUNT GRAVATT. Queensland. 4122

### QUEENSLAND STATE EXECUTIVE FOR 1979

| | |
|---|---|
| PRESIDENT: | Mr. Geoffrey Roberts<br>*Mount Gravatt College of Advanced Education* |
| SECRETARY/TREASURER: | Mr. Kingsley Neale<br>*Mount Gravatt College of Advanced Education* |
| COUNCIL MEMBERS: | Mr. Gary Young<br>*Queensland Institute of Technology* |
| | Mr. Jay Lal<br>*Queensland Education Department* |
| | Mr. Douglas Hansen<br>*Queensland School for the Deaf* |
| | Mr. Peter Constant<br>*G.E.C. Automation and Control, Fortitude Valley* |
| | Mr. Temple Kehoe<br>*Division of Health Education*<br>*Fortitude Valley* |

### QUEENSLAND CHAPTER REPORT

*Geoffrey Roberts*
*Chapter President*

The year 1979 has seen the Queensland Chapter of A.S.E.T. move slowly to consolidate its formation as the professional association serving the interests of educational technologists, media producers and media users in Queensland. Five general meetings plus the Annual General Meeting were planned for 1979. At the time of writing, three general meetings have been held covering the topics of producing slide/tape presentations, the use of computors in secondary schools, and effective use of the overhead projector. Subsequent meetings are to include a demonstration of microphotography and the use of the teletext system being installed by a Brisbane commercial television station.

At the time of holding the AGM in July, the Queensland Chapter had 30 fully financial members. A feature of the AGM was a panel discussion on the theme "Educational Television: A Medium of the Future or Yesterday's Magic?" The four panelists represented a diversity of views. Mr. Rod Gilbert, a producer with the Radio and TV Services branch of the Queensland Education Department, presented the practitioner's view, while Mr.

Neil McPherson, Supervisor of Programmes, ABC Queensland, offered a dose of healthy scepticism. Dr. Ortrum Zuber, from C.A.L.T. at Griffith University, offered a positive view of television in tertiary education serving certain specialised functions. Mr. Michael Macklin from the Education Department at Queensland University interpreted the topic freely and offered the meeting a vision of society where the communication and microchip revolution had made formal schooling redundant. The meeting concluded convivially, aided by ample quantities of cheese and wine. The press had been informed about the meeting, and a report was later published in the *Courier Mail* newspaper.

Early in 1979 some difficulty was experienced in attracting members willing to become actively involved in the running of the Chapter, with the result that the then-Secretary/Treasurer, Mr. Robert Neary, and I carried most of the burden until the AGM. However, since the election of the new Council at the AGM, the work load has been spread more equitably. A deliberate effort has also been made to publicise the Association in Queensland, with the result that advertisements have appeared in the teachers' union journal and the professional officers' association magazine. This effort has been rewarded with the recruiting of a number of new members.

A continuing problem with the operation of the Queensland Chapter is meeting the needs of the members and potential members who live outside the Brisbane area. The next year may well see the formation of semi-autonomous groups in places such as Toowoomba and Rockhampton. The Chapter Council has already approached several people in these centres to act as local correspondents and disseminators of information about the Society.

Until the AGM, I was producing the Chapter's *News*, but since then Mr. Jay Lal has taken over this responsibility. Although it was hoped to provide a printed summary of each general meeting, this has not always been possible, which makes it difficult to be seen to be serving the members outside Brisbane.

This year saw two events take place in Queensland which were significant for those interested in educational technology. First there was the holding of the Fifth Annual Conference of the Higher Education Research and Development Society of Australia at Mount Gravatt College of Advanced Education. Dr. Deane Hutton, the first National President of A.S.E.T., presented a paper at this conference. Secondly, Professor Jerry Kemp from San Jose State University visited Brisbane. He conducted an intensive series of seminars for teachers, inspectors, lecturers and media producers on various aspects of instructional design, instructional techniques and media production. Two public lecturers were also given on educational technology in an era of accountability. Professor Kemp's visit was timed to coincide with the annual educational equipment and software display held at Kelvin Grove College of Advanced Education, which also sporsored Professor Kemp's visit.

As the Queensland Chapter of A.S.E.T. moves into its second year of operation it would seem that certain difficulties still remain to be overcome, but I have every confidence that the Chapter will overcome these and go on to play an important role in the development of educational technology in Queensland.

## SOUTH AUSTRALIAN CHAPTER REPORT

### CHAPTER ADDRESS

Educational Technology Centre
81 Flinders Street
ADELAIDE. South Australia. 5000

## SOUTH AUSTRALIAN STATE EXECUTIVE FOR 1979

| | |
|---|---|
| PRESIDENT: | Dr. C. V. Latz<br>*Sturt College of Advanced Education* |
| SECRETARY/TREASURER: | Mr. K. J. Pearson<br>*Educational Technology Centre* |
| COUNCIL MEMBERS: | Mr. P. Dalwood<br>*Educational Technology Centre* |
| | Mr. C. Dunnett<br>*Educational Technology Centre* |
| | Mr. A. Hambrook<br>*Panorama College of Further Education* |
| | Dr. D. Hutton<br>*Salisbury College of Advanced Education* |
| | Mr. P. Jenkins<br>*The Parks Community Centre* |
| | Mr. J. Kirk,<br>*Open College of Further Education* |
| | Mr. R. Miller<br>*Educational Technology Centre* |

## SOUTH AUSTRALIAN CHAPTER REPORT

*Clem Latz*
*Chapter President*

General meetings of the South Australian Chapter were held on four occasions this year. We were fortunate to be able to arrange to have as speaker for the first general meeting of the year Dr. Ray McAleese from the University of Aberdeen, who was visiting South Australia. He spoke on the role of educational technology in institutions of higher education. The topic of the other general meetings were "Educational Technology in Pre-Service Teacher Education Programmes at Sturt College of Advanced Education," "Film Making in Primary and Secondary Schools," and "Technology in Special Education." In this last meeting Dr. Bruce Keepes of Hartley College of Advanced Education and Mr. John Haynes of the Educational Technology Centre described and demonstrated computer-assisted instruction for slow learning and physically handicapped learners and reading aids for the visually handicapped.

The Council has initiated a drive for increased membership among primary and secondary teachers. The effectiveness of this drive will be seen when the invitation for membership subscriptions is issued next February.

The South Australian Chapter was pleased to be able to sponsor a meeting of the National Council of the Society which was held in May. This involved a telephone hook-up of the four capital cities. The meeting was significant in that it formalised the transfer of the National Executive from the South Australian Chapter, the founding group, to the Victorian Chapter. For the members of the South Australian Chapter this symbolised the completing of the process of establishment of the Society as a national organisation and the fulfillment of hopes expressed at the time of the formation of the Society in South Australia in 1975.

I wish to pay tribute to the members of the Council, and especially to Dr. Robert Cannon from the Advisory Centre for University Education at the University of Adelaide for his dedication to the demanding task of editorship of the Society's Yearbook through the first three issues. Through his efforts the quality of the Yearbook has been firmly established. The Society is indebted to him for this service so willingly and so well performed.

# VICTORIAN CHAPTER REPORT

## CHAPTER ADDRESS

P.O. Box 372
HAWTHORN. Victoria. 3122

## VICTORIAN STATE EXECUTIVE FOR 1979

| | |
|---|---|
| PRESIDENT: | Mr. A. C. Millar<br>*Toorak State College* |
| SECRETARY: | Mr. W. Linklater<br>*Swinburne College of Technology* |
| TREASURER: | Mr. D. H. Harrison<br>*Dandenong College of TAFE* |
| COUNCIL MEMBERS: | Mr. D. Adams<br>*Preston North-East Primary School* |
| | Dr. F. B. Ausburn<br>*Monash Univereity* |
| | Dr. L. J. Ausburn<br>*Swinburne Technical College* |
| | Rev. Br. B. Bainbridge<br>*Royal Melbourne Institute of Technology* |
| | Mrs. M. French<br>*Monash Univereity* |
| | Mr. G. C. Garden<br>*Victorian Education Department* |
| | Mrs. H. Griffith<br>*Bendigo Technical College* |
| | Dr. J. G. Hedberg<br>*Univereity of Melbourne* |
| | Mr. J. Julian<br>*Univereity of Melbourne* |
| | Mr. J. C. Lucas<br>*St. Albans East Primary School* |
| | Mr. J. G. Mitchell<br>*Melbourne State College* |

## VICTORIAN CHAPTER REPORT

*Alex C. Millar*
*Chapter President*

The beginning of the Chapter year 1978-79 coincided with the C.E.T.I.A. Seminar on October 25, 1978. This conference was organised by the Chapter in conjunction with the Educational Television Association of Australia (Television Society of Australia). This occasion attracted more than 200 registrations, including a number from interstate. The programme included Mr. Graeme Foster (Tasmanian Media Centre) who addressed the conference's afternoon theme of "Accountability," and Dr. Deane Hutton (Salisbury College of Advanced Education), who talked about the objectives and production of the successful children's commercial television programme "The Curiosity Show." Two ABC senior TV producers discussed highlights of the ABC's schools television service. Altogether, the conference proved to be a successful A.S.E.T. pilot venture into an important type of professional activity.

Following the Annual General Meeting which was held at the close of the C.E.T.I.A. Seminar, Council organised a repeat of the "Educational Technology Happening" that had been well received in 1977. The "Happening" was held at the Krongold Special Education Centre at Monash University, where Meg French had arranged for open inspection of the not insignificant facilities in use at the Centre.

# Computer Assisted Learning at Swinburne College of Technology

KEITH ANDERSON
*Education Officer (Educational Technology)*
*Education Unit*
*Swinburne College of Technology*

## INTRODUCTION

Computer assisted learning employing both large and small computer systems is increasing throughout Australia and overseas. Students at all educational levels are using computer-based materials, and numerous computer-based instructional systems are being developed and utilised.

This article briefly describes the use of computers as a learning medium at Swinburne College of Technology, a college of advanced education and a TAFE college, situated in Hawthorn, an inner suburb of Melbourne. The article includes a more detailed account of one aspect of computer assisted learning at Swinburne - the Victoria Institute of Colleges (VIC) computer assisted instruction system called COALA.

It is hoped that the information presented here about the Swinburne system will be useful to other institutions wishing to develop or utilise computer-based materials for teaching and learning.

Throughout this article, the following definitions will apply:

1. CAL (Computer Assisted Learning): refers to all uses of computers in the learning process including simulation packages, educational calculation packages, as well as tutorial and drill and practice systems

2. CAI (Computer Assisted Instruction): refers to tutorial and drill and practice type materials only, i.e. "traditional" CAI

3. PACKAGE: refers to a self-contained computer programme which can be used independently of any special supervisory or delivery system

## THE HISTORY OF EDUCATIONAL COMPUTING AT SWINBURNE

Some lecturers at Swinburne have for many years been using computers to aid in the teaching of certain topics of some subjects, notably in applied science and engineering courses. Since the early 1970's, enthusiasts in the Applied Chemistry Department have developed or adapted a variety of programmes such as one which develops students' ability to identify compounds. Most of these programmes are run on a PDP 11-40. During the same period, a few lecturers in engineering departments were using the computing facilities to assist with their teaching, and in 1974 a PACER 500 hybrid computer was installed to be used both as a learning aid and as a computational facility. Using it as a learning device was facilitated by special software which enabled students to easily use simulation packages without necessarily knowing anything about computing. These simulations are used in various departments, principally within the Faculties of Applied Science and Engineering, although at least one course in the Arts Faculty has utilised a world economic model on the hybrid computer. In more recent times the National Development Program in Computer Assisted Learning in the UK has produced a considerable amount of tertiary level CAL software, the Computers in the Undergraduate Science Curriculum (CUSC) project and the Engineering Science Project (ESP) materials being of particular relevance. Some of this has been implemented at Swinburne on a Data General "Eclipse" and a PDP 11-40, and it is planned to acquire more of it.

To launch the 1979 year, Council brought John Kirk from South Australia to give a lecture/demonstration on multi-image presentations. Other 1979 activities/topics have included "Wired Teletext" (Telecom), and the Technical and Further Education Services Unit.

The *Newsletter* has continued to keep members informed of Chapter and outside activities. At the time of this report, steps are being taken to expand and improve the service being provided to members by the *Newsletter*, because it is seen as being of great importance to members.

Drs. John Hedberg and Lynna Ausburn have combined to produce a Materials Evaluation and Research Workshop, which will be available to members during 1980 as one of the Pre-Conference Workshops on April 30.

The Chapter has now come through its second year. While 1977-78 was undoubtedly one of growth and excitement, 1978-79 has been typical of the second year in the life of most organisations and has been a quieter and somewhat less productive one. The main problem has been the inheriting of national office and responsibilities by the Victorian Chapter and Council. These responsibilities have included not only day-to-day running of the National Executive but the 1979 Yearbook and the National Conference planned for May, 1980. Council has recognised this as something of a problem and has recruited well for the Council vacancies at the recent Annual General Meeting. Appropriately enough, the name of the film screened at the AGM in October was "Now the Chips are Down." A number of new initiatives have developed as a result of the AGM discussions, and with the effort of a number of talented people being enthusiastically expended, we can look forward to a growth in the diversity and activity of the professional programme A.S.E.T. is endeavouring to provide for its members.

In concluding, my personal thinks are due to the members of Council for their work during 1979, to John Mitchell, Hilary Griffith and Glen Garden for their special roles in the Chapter, and in particular to Bill Linklater and David Harrison, the Chapter secretary and treasurer respectively, and now the National office-bearers. During my six months overseas this year, Bill Linklater stood in for me and found himself balancing two state and two national A.S.E.T. hats. My appreciation goes to Bill, and my best wishes go out to all members as we look forward to a new year of professional activity and development.

Since 1974, a computer managed instruction system developed at Brighton Polytechnic (UK) to assist in the teaching of FORTRAN programming has been in use at Swinburne, as have other "teacher aids" such as objective test marking programmes.

Thus it can be seen that CAL is not new to Swinburne, although the use of tutorial type CAI until recently has been limited to a few self-contained programmes such as a course in BASIC programming on the PDP 11-40 and experiments with DECAL, the Digital Equipment Corporation CAI system. However, in 1978 the CAL facilities at Swinburne were significantly expanded by the introduction of the VIC CAI system known as COALA (COmputer Assisted Learning Applications).

COALA grew out of the work of the VIC Educational Technology Unit which was set up in 1973 to stimulate and develop educational technology in the VIC colleges. A survey of the VIC colleges carried out by that Unit in 1973 revealed that there were 39 different projects being proposed involving the use of computers for teaching. Several of these were funded, one of which became an inter-college project to develop a tutorial, drill and practice type CAI system. A team consisting of academic staff from several VIC colleges, a programmer and other support staff, led by an enthusiastic lecturer from the Royal Melbourne Institute of Technology, was set up, as was a Committee of Management whose membership was drawn from industry, universities and the colleges, to oversee the project. A mini-computer with graphics terminals was purchased for the project and development of COALA took place over five years from 1974 to 1978.

## HOW THE COALA SYSTEM WORKS

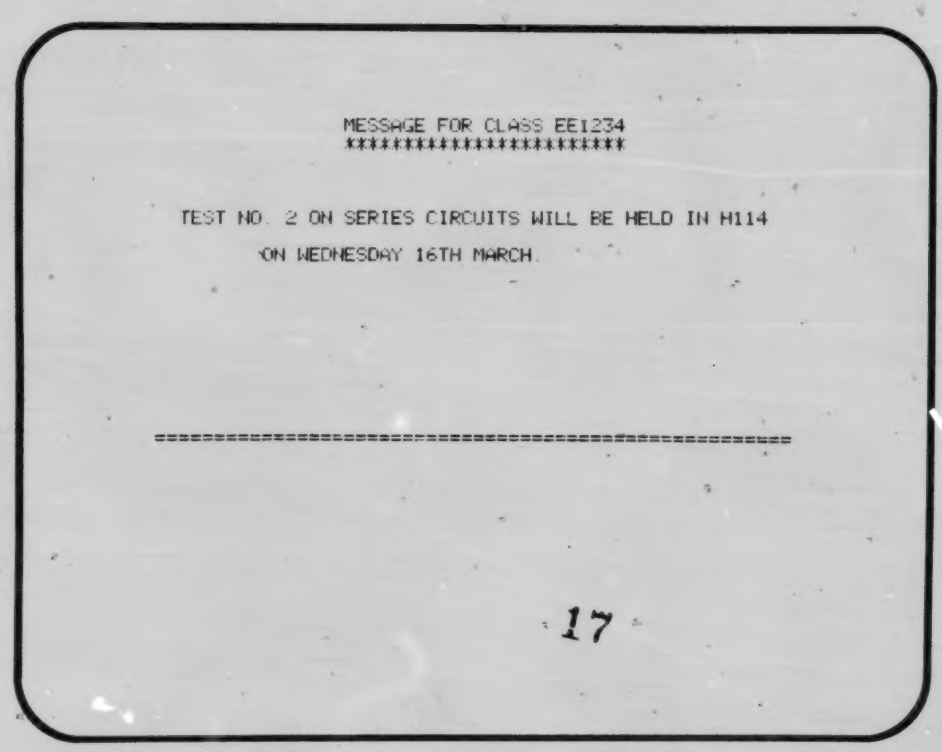
The COALA system was designed as a general-purpose CAI facility so that as well as presenting learning material and processing student responses it also provides students with calculation facilities, bibliographic information, information on their performance, access to packages, etc. Any course which is produced for the system is broken into major sections called "modules," which are sub-divided into "cells" Each "cell" is made up of a number of "frames." Frames are the basic building blocks of the system and typically consist of one or two screens (pages) of text, diagrams, and questions. The system allows for the frames to be organised in any sequence to suit individual lecturers' views of how the course should be structured. It also allows for the inclusion of alternative frames which adopt different teaching methods for the same topic, and the system uses data collected as the student progresses to choose the most appropriate frame for each individual student.

Associated with COALA is an authoring system known as FRESCO (FRame Entering System for COALA) which provides 36 "commands" to enable frames to be generated easily, plus an interactive system for quickly and easily creating diagrams. Flexibility in the type of answers required of students is provided by six different answer matching modes: algebraic expression, numeric expression, text, multiple choice, character string and graphical.

A useful way of gaining an insight into the CAI system is to consider the system from a student's point of view. When the student sits at the terminal he presses the RETURN key and COALA displays the logo shown in Figure 1 and requests him to enter his identification number and the code of the course which he wishes to study. It then displays any messages for his class as a whole and for him personally from his lecturer or tutor, as illustrated in Figure 2.

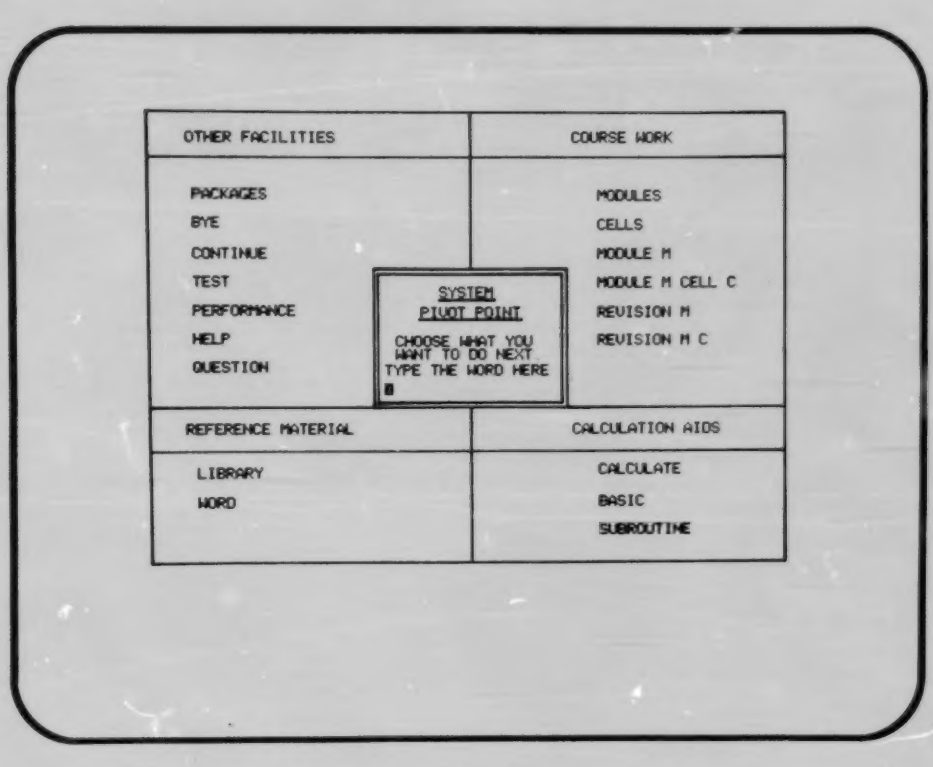
FIGURE 1

FIGURE 2



COALA next displays the System Pivot Point, shown in Figure 3. This is a "choice point" which enables the student to choose to use any of the facilities available in COALA, which are listed in four categories on the screen when he is at this point in the system. Normally, the student is returned to this point after using a facility, but some provision has been made for experienced students to by-pass the Pivot Point to save time.

FIGURE 3




Let us suppose that the student is beginning a course and wishes to view the structure of the course at the module level. He would enter MODULES at the Pivot Point, and the display shown in Figure 4 would appear on the screen.

The student would then select a module on which to being work, for example Module Number 1. COALA would then display the structure of the cells within this module, as shown in Figure 5.

The student would then select a cell to study, and the system would begin to present the first frame specified for this cell. The frame may appear as shown in Figure 6 after being built up step-by-step at a rate decided by the student (The student presses the CARRIAGE RETURN key when he is ready for the next paragraph or diagram.).

At certain points the author has inserted questions to test the understanding of the student, and he must answer before the system will continue. The system responds to the student appropriately, depending on the answer he enters. Figure 7 shows an example of COALA's response to an incorrect answer by a student.

The student continues until he reaches the end of a cell, after which the system returns him to the Pivot Point where he may choose to study the next cell, or to do something else, including to "log-off" by typing BYE.

We have considered here only a few of the facilities available within COALA; most of the others listed at the Pivot Point (see Figure 3) are fairly self-explanatory. The PACKAGES facility gives the student access

FIGURE 4

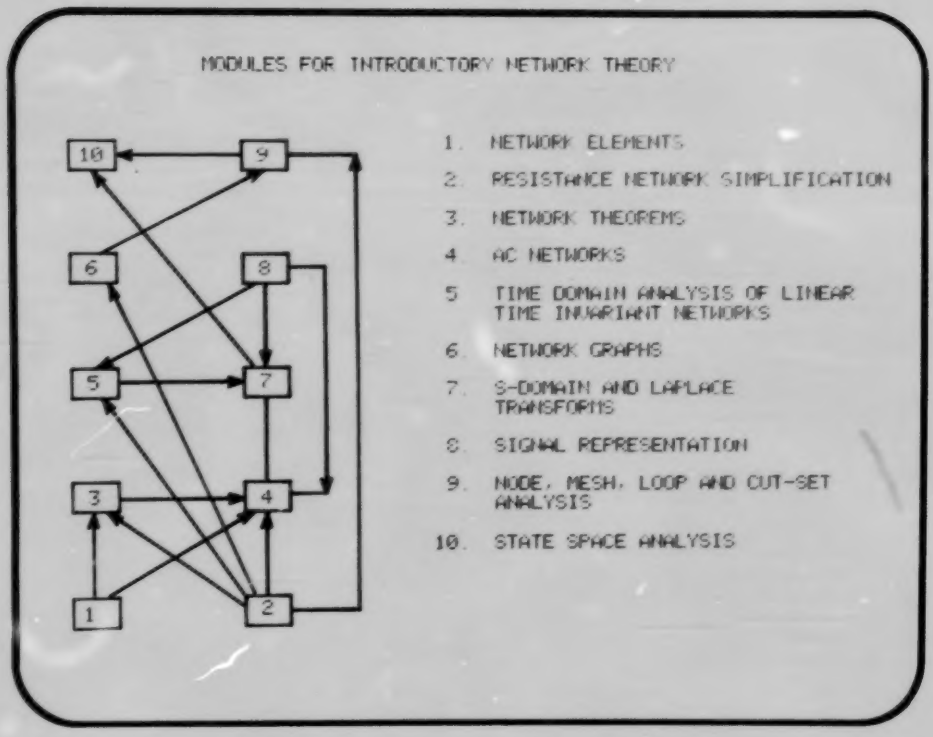



FIGURE 5

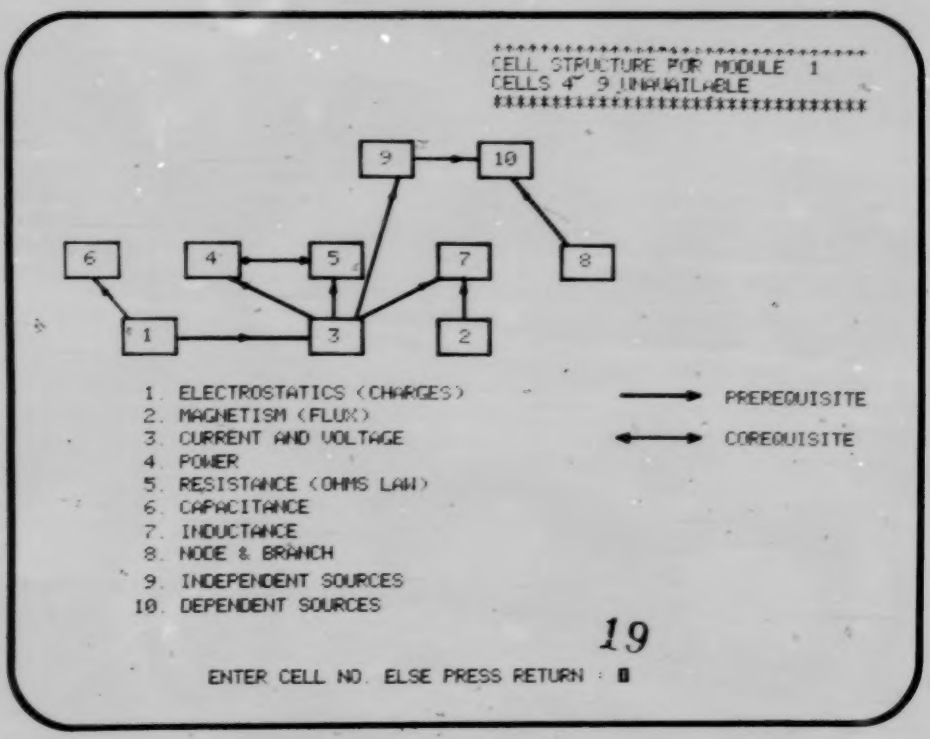


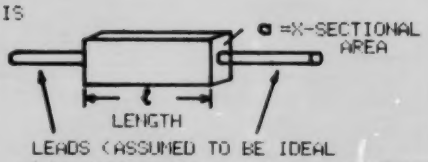
FIGURE 6

THE RESISTANCE R OF MANY MATERIALS IS GIVEN BY

$$R = \frac{\rho \ell}{a}$$

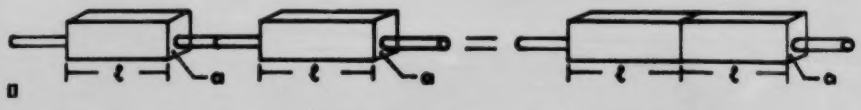
WHERE

$\rho$ = CONSTANT CALLED RESISTIVITY




LEADS (ASSUMED TO BE IDEAL CONDUCTORS WITHOUT ANY RESISTANCE)

WE NOW CONNECT TWO SUCH COMPONENTS, WHICH ARE CALLED RESISTORS, IN THE WAY SHOWN

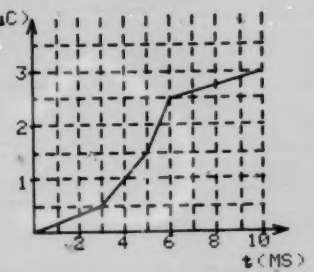


BECAUSE THE LEADS CONNECTING THE TWO PIECES OF MATERIAL ARE ASSUMED TO BE IDEAL (NO RESISTANCE) THE TWO RESISTORS COULD BE REDRAWN AS SHOWN

IF THE TWO RESISTORS BOTH HAVE A RESISTANCE OF R, WHAT WOULD BE THEIR COMBINED RESISTANCE ?

FIGURE 7

THE PLOT SHOWN, IS THE TOTAL CHARGE WHICH HAS PASSED A SPECIFIED REFERENCE POINT, IN A GIVEN DIRECTION.




WHAT IS THE CURRENT AT t=4.5 MS (GIVE THE CURRENT IN MILLIAMP)

$i = 0.5/3 = .16666667$

NO $i = \frac{dq}{dt}$ = SLOPE OF q VS. t GRAPH

AT t=4.5 MS, THE SLOPE OF THE q VS. t GRAPH IS

$$i = \frac{1.5 - \frac{5}{3}}{5 - 3} = .5$$

to a library of simulation and calculational packages, for example RENAL, which simulates the behaviour of a rat's kidney, and FILTERS, which enables students to design a variety of electronic filter circuits.

It should be noted that all of the tutorial course material and most of the packages in the COALA system utilise graphical displays in their outputs, which is one reason why a special area has been set up for CAI at Swinburne, equipped with Tektronix 4010 terminals. The terminals are shown in Figure 8. This facility is managed by the Education Unit of the college and is available to all its departments.

FIGURE 8

## EVALUATING COALA

In first semester 1979, 120 students of electrical engineering were scheduled to use the COALA system for one or two hours per week throughout the semester. At the end of the semester these students and the staff concerned with the subject were asked to complete a questionnaire. Detailed analysis of this questionnaire has not yet been completed, but a preliminary analysis of the responses indicates that COALA is perceived as a useful additional tutorial resource best used in conjunction with the existing lecture/tutorial system. While some students believe that COALA is a better way to consolidate knowledge than is a normal tutorial, others believe the contrary. Very few students (about 10%) would like to see CAI completely replace lecturers and tutorials, although most of them enjoy using computers. These observations accord fairly well with the views of most educational technologists that CAI is a learning resource which will suit the learning style of some students better than others.

## THE FUTURE

What of the future? There is no doubt that the use of computers as a learning medium will continue to expand as long as the college has computers and innovative staff members. The question is: At what rate will it expand? The answer depends mainly on the level of funding available to allow staff to create new course material, packages, etc., and to purchase additional special equipment such as graphics terminals. At the moment the outlook for funding over the next five years is not bright, and this will probably mean that expansion will mainly occur through implementing more material written elsewhere. The production of new tutorial material for COALA and new packages will continue, but at a relatively slow pace. The number of students using CAL and the number of topics for which they will use it will steadily increase as CAL becomes another firmly established learning resource alongside books, audio visual materials, laboratories and academic staff.

# Instructional Development in External Studies

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## INTRODUCTION

The Department of External Studies at the Capricornia Institute of Advanced Education (CIAE) in Rockhampton has expanded rapidly in the last few years. The current enrolment is approximately 1200 students. Broadly, the courses offered externally are in the areas of arts, science and business. One of the aims of the Department of External Studies is to develop the potential of instructional materials in order to enhance student learning.

External students have a diversity of needs, interests, occupations, lifestyles and goals. They differ from Internal students in that they are typically mature, motivated, rich in life-experiences which they can actively apply in their studies. It is the utilisation of associations with previously-learned concepts that, very often, enables these students to master new ideas and concepts more readily.

External students form an obvious group of learners who can benefit from a major concept of educational technology, i.e. that the focus of the instructional system is on the *learner*. Ideally, an instructional system should personalise and individualise. Unfortunately, these terms are often used inappropriately or indiscriminately. The purpose of the following discussion is to clarify and expound on the meanings of these terms as we interpret them at CIAE and incorporate them into the design of our programme of External Studies.

## INDIVIDUALISING LEARNING

An individualised programme of learning for External Studies should include a number of elements, all of equal importance. There is nothing new about these elements, but quite often they are overlooked. It is understandable that specific constraints might preclude some of these elements appearing in an instructional design for an External Studies subject. However, they are worth considering, and we attempt to incorporate them into our External Studies programme design.

1. Diagnosis of the Learner. In the full-time (Internal) teaching situation, instructors will typically revise subject material for the first few class sessions in the new semester. External students don't have the benefit of this classroom strategy because instructors will typically design their study materials to contain only new subject material.

Typically, instructors make assumptions about the prerequisite knowledge with which a learner enters a subject. For External Studies, a set of questions which test prerequisite knowledge can be extremely useful, as it can allow both the External learner and the instructor to realise the learner's strengths or shortcomings and can help the learner see clearly what remedial learning is required to reach the level of prerequisite knowledge. Learning programmes can be developed to meet these needs. These programmes need not be elaborate. The External student can be given cues to guide him or her in acquiring the prerequisite knowledge.

For learners who can indicate quite clearly that they have the prerequisite knowledge, the next step is to pre-test the range of knowledge which each learner has of the new subject material. A well con-

structed, valid and reliable criterion test which spans the domain of knowledge will indicate competence in the parts of a subject from which a learner can be exempted. Care must be taken, however, to ensure that learners are not "crushed" by this criterion test experience should they not be able to respond well to the test. Tests and examinations arouse a great amount of anxiety in External students, especially when they have been out of the formal educational m'lieu for some time. The criterion test should be designed in such a way as to reduce students' feelings of thr t.

2. Options within the Subject Material. Although exemptions from subject material give options to the External learner, there are other ways to include options. Within the subject material, options can be built in, where suitable, so that learners can be allowed to draw on their individual interests and experiences. In this way the subject material becomes more relevant to individual learners, who might create novel and interesting solutions to problems. In a mathematics subject, for example, a learner might be given the option of modelling and problem-solving in his or her particular field of interest, which might be business, science, engineering, etc., depending on the individual learner's experiences and interests.

3. Flexible Learning Time. It is common knowledge that individuals learn at different time rates and learn better at different times of the day or week. If flexibility can be built into the learning system (and External students have such flexibility), then several benefits emerge. The main benefit is that a relatively slow learner can learn at his or her own rate - and reach the same level of competence as the relatively fast learner. The implication of this is that, unlike the traditional system where time of learning is relatively fixed and marks or grades vary, time of learning can vary instead while the level of learning to be reached can be set at a high fixed value. The required criterion of performance often can be detailed in the learning objectives. In some cases if may be appropriate to expect complete mastery of one learning step before the learner goes on to the next step.

4. Choice of Places to Learn. In the traditional pattern of teaching, an instructor "manages" learning within the classroom setting. In an individualised External system of instruction, the parts of the subject material which must, and can only, take place within the classroom need to be determined. In most science subjects, for example, laboratory instruction must be conducted in the appropriate place. However, students need not meet in a group-instructional setting, but can work independently of others, with self-instructional materials. In the sciences, some of the major criteria used for deciding how and where laboratory instruction might be conducted are the availability, accessibility and cost of scientific apparatus. Some simple apparatus can be sent in kits to External students, but most often students must attend the Institute to have access to the apparatus.

5. Optional Means of Learning. Often it is possible to use alternative means (texts, tape, film, lecture, etc.) to bring about the acquisition of an educational objective. Most often, however, a fixed form of learning materials is presented to learners, since the financial constraints of arranging for alternative means is often a deciding factor in their development and availability. However, there is a potential for the development of alternative materials, and, once these are available, learners have the opportunity of selecting from the "menu" of materials to suit their individual learning styles.

6. Methods of Assessment. In the traditional External style of teaching, the two main forms of assessing learning are written papers and the end-of-semester examination. An alternative method is the continuous assessment model with no terminal examination. There are several benefits to this method. The first is that the learner does not have to "cram" as is typical for final exams. Second, the testing encompasses a much greater spread of the range of knowledge to be learned. Third, the learner has continuous information about

his or her progress and can learn in a more satisfactory way, especially because the learning objectives of each unit are known by the learner. Fourth, the instructor is spared the end-of-semester pressure of the assessment process, i.e. marking exam papers. And fifth, the method of assessment should be consonant with the learning objectives. In this way, the learner is not in doubt as to what is to be learned and does not need to "psych out" the instructor to get an idea of how assessment is to be made.

## PERSONALISING INSTRUCTION

External students are remote from campus for most of their academic career. They need to be highly motivated if they are to succeed because of feelings of isolation and the potentially impersonal and faceless Institute with which they are in contact.

Some of the ways in which we try to arrange for a more personal learning atmosphere in the External Studies programme at CIAE are the following:

1. The Instructor. Each set of External instructional materials which we produce at CIAE contains an introductory letter from the instructor. Where possible, we include a curriculum vita of the instructor together with a photograph and a resume of his or her interests, professional goals, and life-style. Often instructors include their home telephone numbers and welcome students to call them after-hours for academic consultation and assistance. Some instructors have even prepared audio tapes which serve: (1) to introduce the instructor; (2) to detail the course structure; (3) to suggest methods of study; (4) to indicate methods of assessment; and, very importantly, (5) to tell the student that the instructor understands the kinds of problems (job-oriented, family, personal and motivational) which the student is liable to encounter.

2. Study Groups. At CIAE we are fortunate to have an extremely competent and creative Student Advisor/Co-ordinator who concentrates his efforts on establishing Study Groups. At the beginning of each semester, he ensures that each student has a list of the telephone numbers and addresses of all students in the same geographic area taking the same subjects. Students are strongly urged to contact the others in the area and form Study Groups. Some of the audio tapes which instructors send out contain advice from the Student Advisor/Co-ordinator as well. This advice might include forming Study Groups, not succumbing to the "slump" which students often feel in the first one-third of the semester, and not hesitating in contacting CIAE when problems arise.

3. Communication. The Department of External Studies has a night telephone recorder system, so that students may call in after-hours and leave a message. First thing each morning, the tape recording is transcribed and messages are relayed promptly to the appropriate person, who then promptly responds to the student.

We also use the night line to receive test answers from learners who are studying a "bridging" mathematics subject. The instructional programme calls for two five-question objective tests to be answered by Sunday each week. The learners call in; they give the name of the subject, their name, the objective test identification number, and their choices of answers to the test questions (such as 1A, 2A, 3C, 4D, 5B). The answers are computer scored each Monday and the results, plus detailed answers, are promptly mailed back to the learners.

4. Marking Papers and Assignments. Two of the most discouraging aspects of assignment work for External learners are seemingly difficult tasks early in the semester, and receiving hard criticism for their efforts. This discouragement can be overcome (1) by making the first assignment less complex than those to follow, (2) by giving guidelines on how to approach the task, and (3) when returning assignments to the learner, by *explaining* errors or inappropriate solutions and, very importantly, by *indicating strengths and giving praise for appropriate methods of solution.*

5. Tutoring. The External student and the instructor are in a situation which is potentially very much like a one-to-one tutorial. While much of the personal and individual monitoring of learning can be done through the post and over the telephone, another very important part of the communication pattern is the academic visit to students.

In the CIAE External Studies programme, each of the geographic areas mentioned previously have a designated Study Centre. Instructors indicate their plan to visit a Study Centre, the students are advised, then the instructor travels to the Study Centre and attends to the various academic needs of individuals who attend the sessions.

6. Vacation Schools. Often, especially in the science subjects, learners need to have practical or laboratory sessions because a demonstration of competence in the laboratory is an integral part of the course. At CIAE, during the State School Holidays, External students attend Residential Schools to fulfill the requirements of laboratory experience. When numbers of students in laboratory sessions are reasonably small, instruction can be carried out on a personal, tutorial-style basis. However, when those numbers increase, a system of individualised audio-tutorial instruction might play a leading part in the Residential School programme for External students.

## SUMMARY

External students need instruction which is personalised and individualised because they are often isolated and lack the guidance and specificity in instruction to which full-time (Internal) students have access. Many External students have been out of contact with formal education for several years and want to know how they should approach the learning task and what they ought to know before they begin learning the new subject material. They often feel anxious about the summary examinations and assignments which they must complete, and thus they need to know how the method of assessment matches up with what they learn.

External students are in an almost ideal situation to benefit from the advances which have been made in educational technology. At CIAE, we attempt to incorporate these advances into an External Studies programme which offers students instruction which is both individualised and personalised. An individualised and personalised approach to instruction could be developed in many External subject areas. We are now using elements of this approach in mathematics, business, management, language, and literature subjects, and our students are reacting favourably. We are optimistic about the use of this approach and the role of educational technology within the approach in our future course development in External Studies.

# Some uses of Video Tape Technology in the Training of Teachers

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The utilisation of relatively inexpensive, reliable portable television facilities in tertiary education is today well established and is no longer regarded as an electronic novelty. Many institutions concerned with improving the performance of student teachers have realised the potential of this new technology and have adapted it into an effective and versatile educational tool. Thomson and Skinner (1970), in their article on using video taping to improve teaching, have listed some of its uses as follows:

1. the use of microteaching techniques to focus on and shape teacher behaviour
2. the use of videotaped classroom situations to supplement direct classroom observation and field experiences
3. the development of instructional materials for both preservice and inservice teacher education programmes
4. the development of simulated classroom materials
5. immediate feedback of teaching performances of inservice and preservice teachers
6. analysis and research of teacher behaviour, pupil behaviour and pupil/teacher interaction
7. supervisory analysis of student teaching and of inservice teaching

A fundamental contribution of video tape technology in the training of teachers is its ability to record electronically classroom and other educational activities, which can be readily and reliably reproduced when required for feedback purposes. With regard to the "reality" of what the video camera records in the classroom, it is only fair to note that a convincing case could be put forward that classroom *cinema verite* is difficult to achieve. It could be argued with Euphraty (1978) that the video recording is not the "incontrovertible evidence" of what actually occurred in the classroom. Classroom reality undoubtedly consists of more happenings than it was possible to record and, more importantly, sometimes of happenings of a different nature than the information finally stored on the video tape, because of the probable gap that exists between the reality of having been there and the recording of what it was like.

Research in motion picture editing indicates that the meaning of filmic images is, to a certain extent, determined by its context and order; that is, the meaning of a shot will be changed by the shot that precedes and/or follows it (Isenhour, 1975). This distortion of the natural process of photographic registration can also occur unwittingly when video recording classroom activities. For example, a wide angle shot of a teacher explaining some aspect of a lesson to a class followed by a close-up shot of a child yawning would very likely produce a different perception of the learning situation than the same shot of the teacher followed by one with an attentive child. The so-called "incontrovertible" recording of classroom reality would be further distorted if the reason for the yawning child was not how and what the teacher was saying, but rather the fact that the child went to bed late the previous night.

However, even if one accepts that filmic communication shapes real experiences in particular ways, one must also accept that direct personal observation of a classroom situation can also be distorted due to inevitable differences in individual perception. It should also be added that when more than one camera is used, a more extensive scanning of the classroom situation is possible, with the result that a more comprehensive recording of what occurred during the lesson is obtained.

Once allowance has been made for these limitations of technical and human functioning, there is one important advantage of videotape technology: Discussions between the tutor and the student teachers of model classroom lessons have no longer to be based on hazy personal recollections of what took place during the session (Trott, 1976). The post-demonstration lesson analysis can now at least be grounded in the stable images and sounds of the video tape.

The usual practice of placing student teachers into a classroom as observers has often presented certain organisational and educational problems. Even when more than one student teacher is able to be placed into a classroom for observation, the ensuing follow-up discussions among all the students in a tutorial group may lack a common basis - if the small groups of students have observed different situations or if the attention of the individual members of these groups has been focused on different aspects of the classroom situation.

Furthermore, it is not always possible to arrange to have all students observe, at the appropriate point of their course, the type of situation they ought to see. Finally, situations exist which, by virtue of their geographical location or special nature, preclude direct observation by all student teachers.

To sum up, the educational advantages of video taped school activities as part of teacher training include the following:

1. The tutor can draw the attention of the whole viewing group directly and convincingly to the significant features of the lesson.

2. A common and credible reference about what has taken place during the lesson is made available for discussion and analysis.

3. The video taped lesson can be reviewed by the students for revision purposes.

4. All students are able to observe a far larger variety of school activities than may be otherwise possible.

5. These situations can be viewed at a convenient time and as often as required.

6. The tutor and the students are able to pick up features of the lesson they may have overlooked initially.

7. Other experts can be brought in during the viewing to participate in the discussion.

8. The impact of the recorded information can be maximised by editing, leaving students to view only significant segments.

9. The size of the viewing group is not limited by the exigencies of classroom space, or the need to minimise the degree of disturbance in classroom routine.

It would not be accurate to claim that video taping in classrooms eliminates the disturbance to which a class is subjected at the same time it reduces the necessity of direct observation of school activities by student teachers. While one source of disturbance is eliminated, another is, of course, introduced. What could be said, however, is that there is probably less interference when video taping is done than is commonly believed. It is surprising how quickly the teachers and pupils forget the presence of the

cameras and microphones and begin to act normally again. The fact that television has been with us now for more than twenty years and that today's children have never known a life without television may have something to do with this.

The aim of letting the classroom function normally is more likely to be achieved if the television facilities used are unobtrusive. At the State College of Victoria at Toorak, our mobile television facilities have been designed with this specific purpose in mind. Because the equipment consists basically of only two small cameras and a self-contained vision mixer and monitor unit (all of which fit easily into the back of a station wagon), it takes up little space in the classroom, and only about half an hour is needed to place the equipment into position, assemble it and make it operational.

Some of the school situations which have been vido taped for study by SCV Toorak student teachers have included techniques of classroom control and management; children's activities in the playground dealing with the environment; approaches to science teaching in primary school; exploratory movement in physical education; observation of young blind children in story telling situations; preps precounting activities; and the teaching of art and music in primary school.

An interesting series of video tapes on rural schools has also been produced. The aim was to make available to student teachers planning to go on rural school rounds material (video and printed) which would show the special nature of rural schools in terms of classroom organisation, the application of the curriculum, the responsibility of the teachers (often a single head teacher), the availability of resources and the special relationship that exists between the school and the local community.

Further utilisation of video tape technology in the effective training of student teachers took place at Toorak in 1978 when the Departments of Educational Technology and Processes of Learning and Teaching cooperated on a School Experience Research Project (S.E.R.P.). This project was designed to investigate and develop means of improving the efficiency of the evaluation, supervision and feedback procedures used in conjunction with student' practical teaching experiences in schools. It required not only the video taping of students giving classroom lessons, but also the recording of the subsequent lesson and discussions that took place between college lecturers, supervising teachers and student teachers. These "post mortem" video recordings allowed all the parties involved to re-appraise their assessment of the lesson and to examine whether the expectations of the lecturer and the supervisor teacher were compatible and appropriate.

## CONCLUSION

The utilisation of video tape technology in teacher training institutions has now been with us for several years. During this period its relevance and its effectiveness have sometimes been questioned by educationalists and administrators alike, especially at times of financial stringency. This does not mean, however, that this technology has no valid and vital role to play in the training of teachers, or that no further educational developments with this medium are taking place. On the contrary, this paper has argued that the utilisation of video tape technology, given recognition of some of its technical and human limitations, can and is making a very important contribution to the difficult process of training student teachers by providing retrievable and stable visual records of school-based learning/teaching situations and by reducing the communication gap between students, supervising teachers and college lecturers when students are on their teaching practice.

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# Making Polystyrene Foam Models for Teaching

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## INTRODUCTION: USING MODELS IN TEACHING

A model may be defined as a three-dimensional object which represents a real thing. It may be desirable for teaching to have the real thing available in the classroom for students to refer to, but there are many real things for which this is impractical since the real thing may be: (Brown, Lewis, and Harcleroad, 1964, p. 416)

- too large to be convenient
- too small to see or handle
- too delicate or transient to handle or keep
- too complex to understand
- too covered or enclosed for examination
- too removed from natural environment to have meaning
- too difficult to find near home
- too expensive to have in every classroom
- too dangerous

It is implied by this list that a model should represent those aspects of the real thing which are relevant to the desired learning but may misrepresent or distort other aspects of the real thing in order to facilitate the desired learning. As Dale puts it:

> " A model is a device that retains many of the advantages of direct experience without certain of its disadvantages. We 'edit' reality by rearranging it -- striking out something here and adding something there, in order to make the meaning clearer .... We try not to sacrifice the quality of direct experience, though sometimes we must. But the material that is edited out is of minor importance. We remove only the complicating, distracting, and confusing elements, so that students can get to the core of the meaning" (Dale, 1969, pp. 215-216).

Many models are designed to display accurately the form or shape of the real thing, or the three-dimensional arrangement of its component parts. The size of the real thing may be scaled up or down to produce a model which is convenient for use and visibility. Examples of such models are a magnified representation of the arrangement of the atoms within a molecule or crystal lattice, or a diminished representation of our planet, a geographical globe.

A model may also display the internal structure of the real thing by showing cross-sections or cutaways or by having portions which may be removed to show parts which would otherwise be hidden. For example, some landform models display the subsurface structure by means of a cross-section. Similarly, a commercially available human torso model employs cutaways and removable parts to display the arrangement of the organs of the body.

A model may perform or simulate the functions of the real thing which it represents. A scale model of a steam locomotive is a model which performs the functions of the real thing. A model volcano in which the "eruption" is produced by igniting a chemical mixture placed in the crater is a model which simulates the functions of the real thing.

The material from which the model is made only rarely needs to be the same as that of the real thing which it represents. This may be necessary in some working models, but for most models the material used for construction needs only to be capable of easy fabrication to the desired shape and surface finish, to be durable in use, and to be inexpensive.

A model (or a real thing) is necessary in teaching when the concepts to be learned are three-dimensional in nature and can only be illustrated by reference to a three-dimensional object. It follows that a model may not be necessary if the learners are able to visualise the three-dimensional concepts by reference to perspective sketches or cross-section diagrams aided by printed captions and text. In fact, there is typically a progression in teaching away from the dependence of the learners on a three-dimensional representation (a model) towards a perspective diagram and on towards various two-dimensional cross-section diagrams. This follows the usual progression in teaching from concrete experience, i.e. the real thing or its model, to abstract representation, i.e. two-dimensional diagrams and words.

It follows that when the concepts to be learned are not essentially three-dimensional or when the learners are sufficiently sophisticated to understand the three-dimensional concepts from more abstract materials such as diagrams, models are not necessary in teaching. Since models are generally expensive to buy, time consuming to make, and rather inflexible in use, the educational benefit to be gained needs to be considered carefully before the decision to use a model is made. The advantages of accessibility and visibility during use and ease of storage are on the side of two-dimensional representations such as charts, transparencies, slides and text book diagrams. Models must be large enough to be seen simultaneously by a group of students and hence are bulky and cumbersome in use and storage.

Despite the disadvantages referred to above, a model should still be considered when planning teaching for its motivational effect. Especially for younger students, the construction of models by the students themselves, either individually or co-operatively in small groups, may be useful in learning three-dimensional concepts and also as an exercise in manipulative and social skills.

## POLYSTYRENE FOAM AS A MODEL MAKING MATERIAL

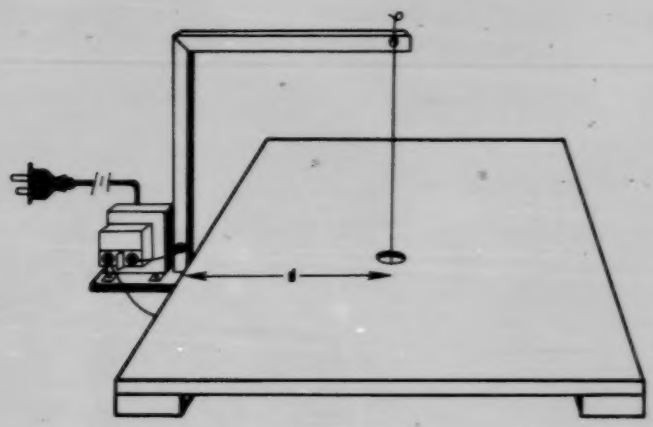
Polystyrene foam fulfills many of the requirements enumerated above for a material from which models can be constructed. It is relatively cheap, light in weight, and easy to fabricate. It is also durable if not handled roughly and may be painted to simulate various materials. It may be purchased in the form of sheets of various thicknesses or in blocks. It is widely available as scrap materials left over from industrial processes or as unwanted packaging. In many instances, this material is available free from factories and importers provided it is taken in large quantities, e.g. by the truckload.

Polystyrene foam may be cut with a saw or with a sharp knife, although care is needed in this latter case to avoid crushing it. It can be shaped with a wood rasp and finished with a file and sandpaper. However, since polystyrene foam melts at approximately 100 degrees Centigrade, it is easily cut and shaped by using hot wire cutters. The fumes produced when polystyrene melts are dangerous, so it is essential to work in a well ventilated area from which an exhaust fan removes the fumes before they can be circulated by the air conditioning or by natural means to others in the building. If possible, it might be best to do the cutting and shaping in the open air.

## CONSTRUCTING A HOT WIRE CUTTER FOR POLYSTYRENE FOAM

Hot wire cutters are available commercially, but they are comparatively simple to construct from readily available materials as the following description will show. A very useful cutter is the one pictured in Figure 1.

FIGURE 1
Polystyrene Foam Cutter




The base board should be made of chipboard 12 or 16 mm thick, or it could be an existing table top. It should be large enough (about 1 metre square) for the convenient handling of large sheets of foam. The distance "d" in Figure 1 should be at least 500 mm, since this distance places a limit on the width of pieces which may be cut. The length of the cutting wire should be approximately 300 mm (see below for additional information on this point). The arm holding the upper end of the wire may be made of wood or metal, but it must be springy so that it holds the wire in tension even when it expands on heating.

The temperature required in the wire is such that the polystyrene foam is readily melted by it. This temperature can be determined by trial as described here. The wire must easily melt a narrow track through the foam as the sheet is pushed past the wire. If the temperature of the wire is too low the foam will not melt readily and the cut surface will be torn and uneven. In applying force to push the foam past the wire it is likely that the wire will be distorted if it is not hot enough, thus giving a slanting, irregular cut. It is also likely that the wire will break. On the other hand, if the temperature of the wire is too high it will very rapidly melt a wide track through the foam. Any slight hesitation in moving the foam past the wire allows a hole to be melted which appears as an irregularity on the cut surface.

The wire is heated by passing current through it from a low voltage power supply. A school science laboratory low voltage power supply may be suitable and may have the added advantage of producing a voltage which may be varied to suit the thickness of the foam being cut. A Scope soldering iron transformer, available from electrical equipment suppliers, is a comparatively cheap, robust, low voltage supply. The output voltage is not variable, but this is not a major disadvantage. The wire may be ordinary steel wire, available from hardware stores, although nichrome resistance wire will probably last longer before breaking.

Before constructing the supporting arm for the wire, it is necessary to decide on the exact length of the cutting wire which will be required. This can be done by experimenting with wires of various thicknesses until a wire is found which reaches a suitable temperature when the current from the available low voltage power supply is passed through a length of approximately 300 mm of the wire. A wire having a resistance of approximately five ohms per metre length of wire will probably prove to be suitable when heated by a Scope soldering iron transformer having an output voltage of three volts. At this stage it is best to decide on a thickness and length which will reach a temperature slightly higher than is required, as it is comparatively

easy to reduce the temperature to a suitable value at a later stage in the construction of the cutter (see information below).

If a variable voltage power supply is available, a wire should be chosen so that a suitable temperature is attained when the voltage is set at a comparatively low value.

Having decided on the exact length of the cutting wire, the arm should then be constructed so that this length of wire can be held in tension between two clamps, one on the arm and the other beneath the hole in the baseboard. The clamps need not be elaborate; simple nuts and bolts will do provided that the wire is held between washers so that there are no sharp bends or knicks in the wire where it is clamped. Any distortion of the wire at the clamps will result in frequent annoying breakages of the wire at the point where it is distorted.

It may be an advantage if the upper end of the wire can be removed easily from the upper clamp. This will permit the wire to be detached from the arm and passed through a hole in a piece of foam so that internal shapes may be cut. By internal shapes are meant the centres of letters such as "O" or "B" or similarly placed pieces which ideally should be removed without cutting through the surrounding foam. If the wire is not easily removable from the upper clamp, these internal shapes can be produced by cutting through the outer rim of the letter in order to place the wire into a position to cut the internal shape. After the cut has been made, the power should then be switched off so that the cold wire can be eased out through the rim of the letter without widening the cut. The narrow cut through the rim of the letter will scarcely be noticed in the finished display. Alternatively, these internal shapes may be cut using the hand-held cutter described below.

The transformer may be mounted near the vertical portion of the arm on the side away from the working surface. If the arm is made of metal, the arm itself may be used to connect the upper end of the wire to one of the low voltage terminals of the transformer. The output voltage is approximately three volts, so that it is not necessary to cover the output terminals or the connecting wires. The input side of the transformer is connected to the 240 volt mains supply and, of course, this must comply with electrical safety requirements. The cutting wire should not be touched as it is hot enough to cause a burn. Thick copper wire should be used beneath the baseboard to connect the other output terminal of the transformer to the lower end of the cutting wire.

If on testing the cutter it is found that the temperature of the cutting wire is too high, the temperature can be reduced by replacing some of the copper connecting wire beneath the base board with additional cutting wire as shown in Figure 2. This additional cutting wire will also become hot, and so it should be supported in such a way that it is not touching the base board but is held in the air space beneath it. The base board will need to be supported above the table top on blocks fixed to the underside of the board. The additional cutting wire will remain cooler if two or three pieces of wire are connected in parallel. The length of additional wire required to produce a suitable temperature in the cutting wire can be found by trial and error.

A hand-held polystyrene cutter can be made by fixing a loop of stiff resistance wire to a wooden handle as shown in Figure 3. The wire is heated by connecting it to the low voltage power supply using thick flexible leads. The loop may be bent into various shapes for gouging out hollows which are broad or narrow as required for the model being made. For this purpose the cutter is used like an icecream scoop. For shaping external curves in three dimensions, one side of the loop is used like a knife to pare away the unwanted foam. Since it is not possible to guide this cutter very accurately, it is usually necessary to finish the shaping by using a rasp, then a file and then sandpaper.

FIGURE 2
Polystyrene Foam Cutter in Cross Section

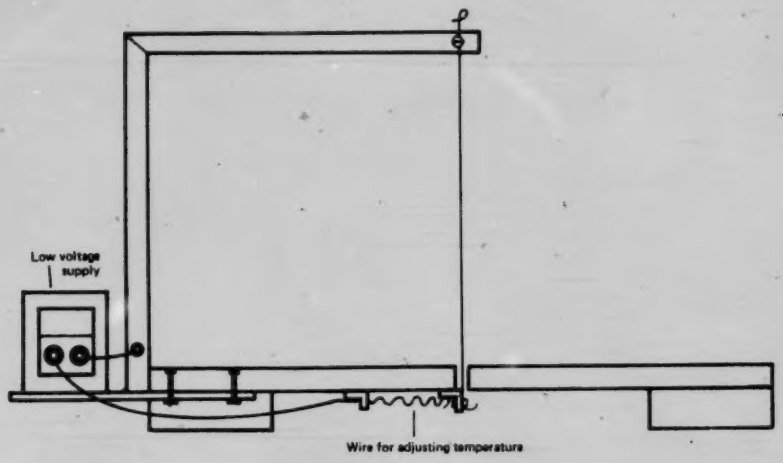
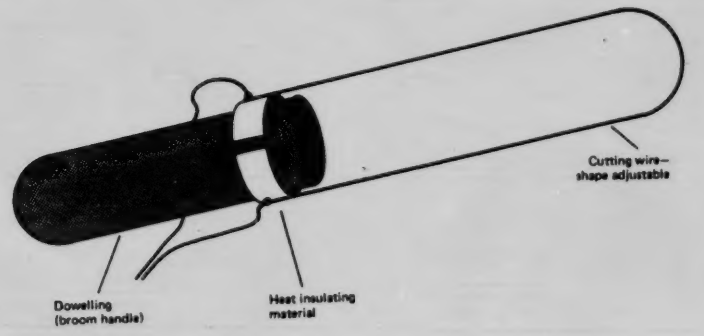



FIGURE 3
Hand Held Polystyrene Foam Cutter




## TIPS FOR MAKING POLYSTYRENE MODELS

The larger cutter described above is typically used for cutting shapes from sheets of foam. The cuts are at right angles to the surface of the sheet which is moved around on the base board in order to make the cuts. It is rather difficult to guide the foam sheet accurately enough to cut smoothly along lines drawn on the surface of the sheet. In order to produce smooth outlines without filing and sanding, which is time consuming and rather messy because of the fine clinging dust produced, it is usually advisable to cut the desired shape out of cardboard which is then used as a stencil. The stencil is pinned to the surface of the sheet of foam and the shape is cut by guiding the sheet so that the cutting wire is always touching the edge of the stencil.

Polystyrene letters are excellent for use as the titles of displays. They are not difficult to produce. A suitable alphabet of printed letters can be found and used as the original to make a thermal transparency.

This is then projected at a suitable size onto a sheet of cardboard. The required letters can then be traced and cut out to become the stencils for cutting the foam.

For cutting straight lines in polystyrene, it is best to clamp to the cutting board a straight piece of wood to act as a fence against which the sheet of foam is held as it is pushed past the cutting wire. For cutting circles and cylinders, a circular wooden turntable rotating about a vertical axis can be used to hold the piece of foam while it is rotated past the cutting wire. For cutting cones, the base of the turntable is clamped to the cutting board in a tilted position so that the turntable's axis of rotation is inclined to the vertical. The turntable will be easier to use if it has a non-slip surface such as coarse sandpaper on which the foam can be held firmly while the turntable is rotated.

Pieces of foam may be glued together to make complex shapes, and sheets may be glued in stacks to produce blocks thicker than the readily available sheet thicknesses. It is best if all the hot wire cutting and shaping is done before the pieces are glued together as the glue does not melt in the same way as the foam, making it difficult to cut through glued surfaces. In most cases it is comparatively easy to hold the blocks together manually or with strips of masking tape while the hot wire cutting is done. After the pieces are glued the joints can be smoothed with sandpaper. The best glue to use is a polystyrene foam adhesive, such as Scotch-Grip 6998, which is available from the 3M Company. PVA glues such as Aquadhere can also be used, but they are very slow to dry since the water in the glue cannot readily evaporate from between the foam sheets.

The surface of the model may be painted with any water based paint. This includes many paints available from commercial point suppliers and artist paints such the following:

1. "Chromacryl" Acrylic Colour, available from Chroma Acrylics (Sydney)
2. "Derivan" Students Acrylic Colour, available from Vynol Paints Pty. Ltd., 40 Burrows Road, Alexandria, New South Wales

The adhesion of the paint and the uniformity of the colour of the surface may be improved by mixing with the paint a small quantity of diluted PVA glue such as Aquadhere. The surface finish may be made very smooth and uniform by using flat plastic household paint with a small quantity of PVA glue mixed into it as an undercoat.

Various organic solvents dissolve polystyrene very readily. The spirit bases of many paints and glues fall into this category. It is most disappointing to see a model on which considerable time and effort have been expended disintegrating rapidly under a paint brush. If there is any doubt about the effects of a paint or glue on the foam, it should first be tested on some scrap pieces. Spirit-based pressure pack paints can be used to produce interesting effects when sprayed lightly onto foam blocks and sheets, the surfaces of which are partially dissolved while being coloured by the paint. The metal finish paints produce particularly striking effects in this way.

The production of accurately shaped spheres from polystyrene foam is rather tedious, especially if numbers of similar sizes are required for the making of models of molecures or crystal lattices. Spheres of various sizes are available ready-made from craft supplies shops. Although these are rather expensive, they are accurate in shape and size and have a smooth surface finish, characteristics which are difficult to achieve by the methods described in this paper. They may, however, be cut and glued and painted in the ways described here.

## CONCLUSION

When polystyrene foam is cut, shaped, glued, and painted using devices and techniques such as those suggested here, the result can be the production of some interesting, attractive, and extremely useful models

for instruction. Figure 4 (next page) shows some examples of polystyrene models created by teacher education students at Sturt College of Advanced Education.

Using simple home-made equipment and some imagination, educators at all levels can produce polystyrene models to aid in the teaching of a wide variety of subjects and topics.

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Dale, E. *Audiovisual methods in teaching* (3rd ed.). New York: Holt, Rinehart and Winston, 1969.

# The Curriculum Materials Descriptive Profile Project

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## BACKGROUND TO THE SYSTEM

In 1977 the Curriculum Development Centre (C.D.C.) funded a project of basic research related to the dissemination and exchange of information about curriculum materials at local, state and national levels. This paper will report on the research carried out to date, and will briefly discuss the researchers' plans for the future development and potential uses of the system devised. The researchers involved in the project, called the Descriptive Profile Project, are the authors of this paper and Dr. G. A. Trevaskis, Principal of the State College of Victoria at Frankston.

The Project was established with the following goals:

1. investigate current practices in reviewing and evaluating curriculum materials in Australia
2. develop and refine standardised criteria, procedures and formats for detailed objective description and evaluation of materials
3. produce a manual as a guide to reviewing curriculum materials
4. develop an information service (systems based) centred on the manual

To date the research team has produced a manual, thesaurus, and record sheet suitable for recording information about learning and teaching materials for the social sciences.

## WHAT IS SPECIAL ABOUT CURRICULUM MATERIALS?

The use of teaching and learning materials in classrooms and libraries at all levels of education has increased dramatically over the last ten years. Improvements in most teacher training courses, made possible by the lengthening of such programmes from two to three years, has meant that it is possible to offer education students courses in media planning and production and in the educational uses of learning materials. Practicing teachers are aware of such materials through school resource centres or regional education centres which have been established in selected areas of each state. During the last ten years there have also been a number of technological developments which have enhanced the quality and universality of learning materials.

These changes in teacher education, the development of resource centres, and the increase in the production of learning materials have been accompanied by a gradual shift from a highly structured curriculum to a school-based approach. This has allowed both teachers and learners to use learning materials more frequently and has placed a greater demand on resources. The overall increase in the use of such resources has encouraged the importing of greater quantities of learning resources and allowed a small but active local production industry to become established in Australia.

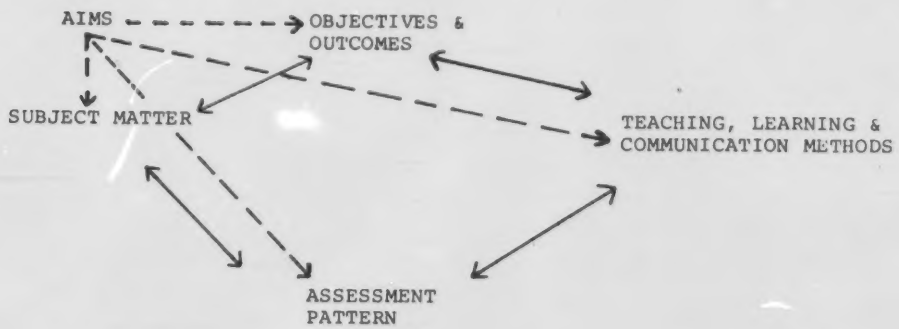
This growth has become a problem because, with the exception of the *TAFE National Union Catalogue of Audio Visual Materials*, there has not yet been any accompanying improvement in the quality of bibliographic control of these materials, nor have comprehensive information services for the Australian market yet been established. While the practising teacher may welcome an increase in resources from which to select, it is soon discovered when attempting to select a few items that what bibliographic control exists is fragmented and disorganised.

Ideally, a teacher should be able to specify precise learning objectives for students and to identify suitable materials to facilitate learning tasks. Thus, in addition to seeking materials containing appropriate subject matter, a teacher may need to identify materials in a particular format with a particular approach to that subject, designed for a specific classroom environment, using certain instructional techniques. There is as yet no method of retrieving information to meet this kind of need.

The interaction of all the factors displayed in Eraut's (n.d.) curriculum model, shown in Figure 1, is now well understood by the increasing number of teachers involved in school-based curriculum development. However, the relation of all these factors to the selection and design of curriculum materials is not as widely recognised.

FIGURE 1

Eraut's Curriculum Model




The fact that "subject matter" is only one facet of the content of curriculum materials is rarely acknowledged in published reviews and in existing systems of information storage and retrieval. What Eraut terms "Teaching, Learning and Communication Methods" might be, in some instances, the prime basis of retrieval.

Since it is not yet possible to retrieve materials in such a manner, the Curriculum Information Service through the Descriptive Profiles Project may offer a possible way to develop a system which provides retrieval in this fashion.

## REVIEWING CURRICULUM MATERIALS: CURRENT PRACTICE IN AUSTRALIA

The research team have issued a first stage report, *Reviewing Curriculum Materials in Australia*, which was submitted to the C.D.C. Council in March, 1978 (Carrol, Roe, & Trevaski, 1978). Reviews at present are the major source of information about curriculum materials available to curriculum developers and teachers in Australia. The survey conducted by the research team into reviewing practices had as its main purposes:

1. to analyse the policies and practices associated with the reviewing of curriculum materials
2. to document patterns and styles in reviews of curriculum materials
3. to recommend on matters related to the reviewing of curriculum materials

The research team prepared a questionnaire for all persons involved in the reviewing of curriculum materials to complete. Members of the team visited each state in order to distribute the forms to as many respondents as possible and to discuss the survey. In December, 1977, the completed forms were analysed. The survey provided some insight into the problem of reviews of curriculum materials, and it is therefore useful to discuss some of the most important finding and recommendations made by the researchers.

The questionnaire was designed to elicit information concerning:

1. the purpose of reviews
2. reviewers
3. selection of materials for reviews
4. publication of reviews
5. use of reviews
6. general comments

The structure of the questionnaire enabled respondents to answer specific questions and to include their comments on any matter in the final open-ended question.

In response to the questions related to the reasons for reviewing, most of the respondents indicated that they sought to provide an information service. A much smaller group also wished to provide feedback for publishers or producers. Only one respondent indicated the reviews were used to build a collection.

Responses to the questions on the selection of reviewers indicated that in the majority of cases reviewers are required to write reviews as part of their professional responsibility. In nearly as many instances, however, volunteers were encouraged to write reviews, and subject specialists were also frequently asked to review materials. In response to a question concerning guidelines given to reviewers, about one-fourth of all respondents indicated that detailed guidelines were given to reviewers, while similar numbers indicated that broad headings but no specific directions were given to their reviewers. Approximately the same number of respondents indicated that either some limited direction was given, or that no guidelines were provided to reviewers.

When asked to list their criteria for selecting materials for review, over one-third of respondents indicated that they reviewed complimentary copies of books provided by publishers. About one-fourth of respondents indicated that interest in projects or needs of teachers were their reasons for selecting material for review. About one-fifth of respondents indicated that they selected for review those curriculum materials which were known to be popular or favourably reviewed elsewhere.

General comments were useful, but too numerous to include here. Perhaps the most interesting comment - which was a plea to "publish unfavourable reviews" - might lead us to believe that censorship of unfavourable reviews is applied as a matter of policy in at least one state.

Those responding to the survey were asked to send samples of the reviewing journals published by their organisation. Samples of such journals, ranging from single mimeographed sheets to fully bound journals, were in fact returned with the questionnaires. A content analysis of a large number of entries in the publications sent in enabled the researchers to develop a system for analysing the content of reviews. The list of descriptors used for this content analysis is as follows:

A. <u>Item Identification</u>

1 author 2 title 3 publisher 4 place of publication
5 date of publication 6 series 7 place in series
8 accompanying materials 9 cost 10 copyright status
11 language 12 restrictions 13 consumer report

Review Identification

14 date 15 name 16 address 17 location of item
18 accessibility 19 source 20 experience

B. Physical Characteristics

1 medium 2 format 3 dimensions 4 packaging 5 hardware needed

C. Content

1 curriculum area 2 topic 3 language 4 accuracy
5 approach to subject 6 relationships with other topics and disciplines
7 instructional use 8 basic unit organisation 9 accompanying material
10 time allotment 11 instructional techniques 12 general educational purposes

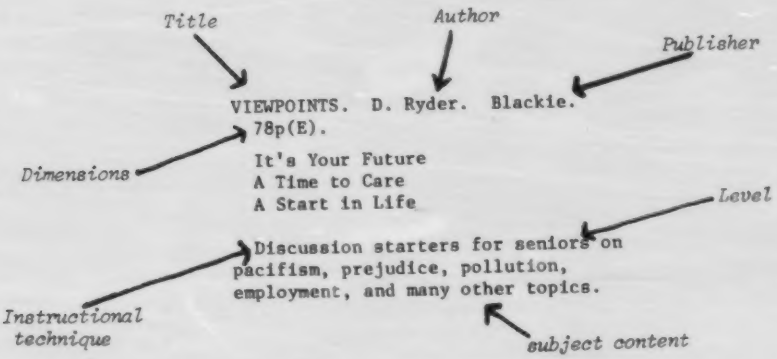
D. Orientation

1 level 2 target group 3 teaching environment 4 modifications and revisions

As the sample from a review shown in Figure 2 illustrates, the type of information contained in a review may be gathered by using the descriptors listed above.

FIGURE 2

Review Sample




The research team made the following recommendations in its report:

1. a national information system be established by the Curriculum Development Centre to disseminate basic descriptive information on curriculum materials

2. the information system be both objective and sufficiently detailed to serve national and state needs and, at the same time, provide a framework for evaluation at state, regional and local levels

3. the Curriculum Development Centre in association with the states support the establishment of a collection of reviewed items of materials so that consumers of review information may use that information to identify, examine and evaluate materials for their own purposes

## OTHER SCHEMES FOR ANALYSING CURRICULUM MATERIALS

There have been, since the late 1960's, a number of schemes for analysing curriculum materials, which are listed in the Bibliography appended to this paper. These schemes have been written up and described in considerable detail, but it is very difficult to find information on how, or indeed if, the schemes have been used. Most of the accounts stop at describing problems in finding useful areas for analysis and/or the problems

of training people to do the analyses. The schemes usually require the analyst to make value-loaded decisions based on the assumption that the analyst is extremely well informed about the people to be taught (Eraut, n.d.). Furthermore, most schemes make assumptions about how people learn, frequently couching their analysis in behaviourist terms explained in glossaries which read like an educational psychology text book (See, for example, Eash, 1972). The researchers involved in the Descriptive Profile Project made no such assumptions.

## OBJECTIVITY: ITS IMPORTANCE IN RECORDING INFORMATION

The question of "objectivity" in recording information about curriculum materials is an extremely important one, and its relationship to the Descriptive Profiles System needs clarification. Information through the typical review is subjective, reflecting the opinion of the reviewer both in what is selected for review and in the content of the review. Provided the reader shares and/or is aware of the bias of the reviewing journal and the reviewer, the information retrieved is often easier for the reader to process than more descriptive or objective information.

The reasons for this are not very complex. It appears that the information most frequently sought, and possibly most highly valued, is the information that a user can most easily process and use. For example, librarians highly value and most easily record, seek and use bibliographic information about curriculum materials; teachers highly value and most easily seek information about educational content and intellectual level of curriculum materials; while producers/publishers value and seek information on physical characteristics and access.

This self-perpetuating cycle limits the ability of those that use, design, teach about, and produce curriculum materials to handle categories of information not previously provided. Their skill in processing information - applying information received in the process of selecting materials for review, purchase, modification or production - is limited both by their expectations of what can and should be provided and by past experience.

To date, information about curriculum materials has been provided by producers/publishers, teachers and/or librarians for producers/publishers, teachers and/or librarians, and learners. The bias of each group is evident in the materials described, reviewed or listed as well as in the information provided about the material. Each of these groups presently prepares lists and bibliographies which may be subjectively rated as good, bad, or mediocre. The problem is that with such reviews there is no standard of comparison between the opinions of reviewers. Hence, many users approach the recommendations of a review with well-advised caution. In many cases, such recommendations are made spurious by the caution of readers, because opinions expressed in reviews are rightfully suspect.

The difficult task is devising a method for analysis and description of teaching and learning materials which seeks to incorporate and transcend the differing needs of all users. The aim of the Descriptive Profile Project is to provide a system capable of storing sufficient descriptive information that can be retrieved and used by all groups. It is not expected that all categories of information provided about a material will be sought initially by all groups of users. However, as the individual user becomes more skilled at requesting and using information, it is expected that the need for all categories of information will be more readily understood and sought and expectations changed.

## THE DESCRIPTIVE PROFILE SYSTEM

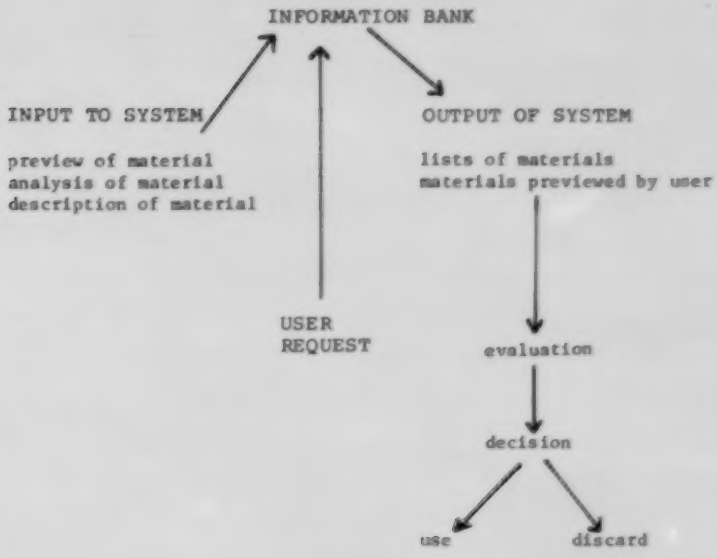
The Curriculum Materials Descriptive Profile System has been devised to fulfill a comprehensive role. It goes beyond bibliographic and subject content information to include both the educational use and context

for which an item has been designed, and the methods of communication used in that item.

Each item is analysed in detail, and the description is entered into an information bank. In retrieving information about items, users are required to specify what they want in terms of bibliographic information or academic subject content, instructional methodology, or educational use. When users have retrieved author, title and location of the material, they may preview it, evaluate its usefulness for their purposes, and make a decision either to use or discard it. The process may be represented as shown in Figure 3.

FIGURE 3

Descriptive Profile Information System




A manual has been prepared for the Descriptive Profile Project. This manual, described later in this paper, prescribes in detail both sequence and structure for preparing a description of an item for input into the information bank.

Superficially, the obvious disadvantage of the system developed by the project team is that to analyse and describe an item takes time. However, the team believes that it is an expenditure of time and effort which will lead to even greater savings in time and effort across the broad spectrum of curriculum development. The price is well worth paying in order to lead to comprehensive bibliographic detail as the basis for an information system meeting the needs of a wide variety of users. Anything less than such a approach would be of limited value to curriculum developers, teacher educators, and ultimately the classroom teacher, beacuse ommission of reference to instructional techniques and educational context would mean failure to provide information necessary to select appropriate instructional materials.

The project team believes that the system should be of special value in teacher education and that teacher educators in various tertiary institutions could be a significant category of users. By analysing and describing materials with particular reference to their use, teachers in training will come into contact with educational issues, obtain practical insights into the processes of learning and the problems of learners, and develop significant teaching skills.

The use of the system by teacher educators, both in terms of input and output, should also guarantee that the system will develop, expand and change with each new generation of teachers and curriculum developers.

## Use of the System

A full descriptive profile contains information on the following aspects of a curriculum material:

(a) ITEM IDENTIFICATION AND ACCESS TO ITEM

author - translator - illustrator - title - language - medium - series - accompanying materials - curriculum project - sponsoring body - publishing data - copyright - costs - constraints on use - location of item - review information - field trial information

(b) PHYSICAL DESCRIPTION

medium - print material - projected material (motion picture - transparency-slide - filmstrip) - sound recording - video recording - activity material - kit

(c) CONTENT

curriculum area - sequence and organisation - accompanying material - instructional techniques - learning skills and tasks - assessment

(d) EDUCATIONAL CONTEXT

teacher - student - level of instruction - type of institution - learning environment - class organisation - community resources

A descriptive profile is drawn up by following a sequence of directions associated with each of the sections listed above.

Three documents made up the system:

VOLUME 1: *THE MANUAL* - Contains step-by-step instructions for preparing a descriptive profile

VOLUME 2: *THE THESAURUS* - Contains the specific words and phrases, or descriptors, which are used in preparing a descriptive profile

VOLUME 3: *THE RECORD PAD (expendable)* - Contains forms on which to prepare a descriptive profile

These documents at present cover only social science materials. After field trials, further documents for other subject areas in the curriculum will be developed.

## The Manual

The manual is made up of four sections:

SECTION 1: *ITEM IDENTIFICATION AND ACCESS TO ITEM*

In this section directions are given for recording information about the origin of the material, its location and its acquisition.

SECTION 2: *PHYSICAL DESCRIPTION*

In this section directions are given for describing media and format details.

SECTION 3: *CONTENT*

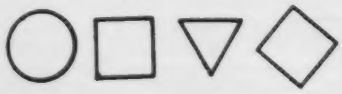
In this section directions are given for describing the subject content and the instructional techniques employed to present that content.

SECTION 4: *EDUCATIONAL CONTEXT*

In this section directions are given for describing the educational environemnt for using the material.

## The Symbols

The manual uses a number of symbols to help guide responses to directions. The four symbols used are the following:



The symbols identify the four main sections of the descriptive profile as described above.

identifies directions in SECTION 1 for recording the origin of the material, its location and acquisition

identifies directions in SECTION 2 for recording media and format details of the material

identifies directions in SECTION 3 for recording information about subject content of the material and instructional techniques used in communicating the content

identifies directions in SECTION 4 for recording the educational environment in which the material is to be used

Directions within each of the main sections are numbered, and that number is always shown within the symbol for that section. For example:

refers to directions given within the media and format section for describing the physical characteristics of PRINT MATERIAL

refers to directions given within the media and format section for describing the physical characteristics of SLIDES

refers to directions given in the content section for describing SEQUENCE AND ORGANISATION

refers to directions given in the educational context section for describing the TYPE OF STUDENT for whom the material is intended

Sequence of Proceeding through the Manual

It is essential in preparing a descriptive profile to adhere to the sequence prescribed in the manual. At the bottom of most pages the next step in completing the profile is given. For example:

IF THE MATERIAL IS

A BOOK
proceed to


NOT A BOOK
proceed to


This means that the next part of the profile to be completed is the section containing directions for describing a book (C) or the general design aspects of non-print materials (D).

The Thesaurus

In the thesaurus are listed words and phrases (*descriptors*) which provide choices of responses to directions given in the manual for describing an item of curriculum material.

In the thesaurus, the descriptors are grouped together into clusters called *arrays*. Array headings are given in capital letters. Examples of array headings in the thesaurus are:

MEDIUM

IDENTIFICATION NUMBERS

COSTS

Under each array are listed several relevant descriptors. For example, under the array heading MEDIUM the following descriptors appear:

MEDIUM

| | |
|---|---|
| PR | print |
| MP | motion picture |
| FS | filmstrip |
| SL | slide |
| TR | transparency |
| SR | sound recording |
| VR | video recording |
| AM | activity material |
| KI | kit |

In building a descriptive profile of an item, the thesaurus is used in conjunction with the manual. Following directions given in the manual, reference is made to various arrays in the thesaurus. From the arrays are selected the descriptors appropriate for the item for which a profile is being compiled. These are recorded on the record form discussed below. The descriptors chosen from each array form the descriptive profile which becomes part of the Curriculum Materials Information System.

The Record Form

Each descriptive profile is recorded on a record form. These forms are made up into a pad. As the directions in the manual are followed, responses in the form of descriptors chosen from the arrays in the thesaurus are written on the form. The symbol and number for each direction are reproduced on the record form as a guide to writing each response in the correct place on the form. The record form is shown in Figure 4.

When a record form is completed, it contains a full descriptive profile of an item based on specific and uniform descriptors. This profile can then be entered into the information bank and can be retrieved by users of the bank seeking curriculum materials of various types.

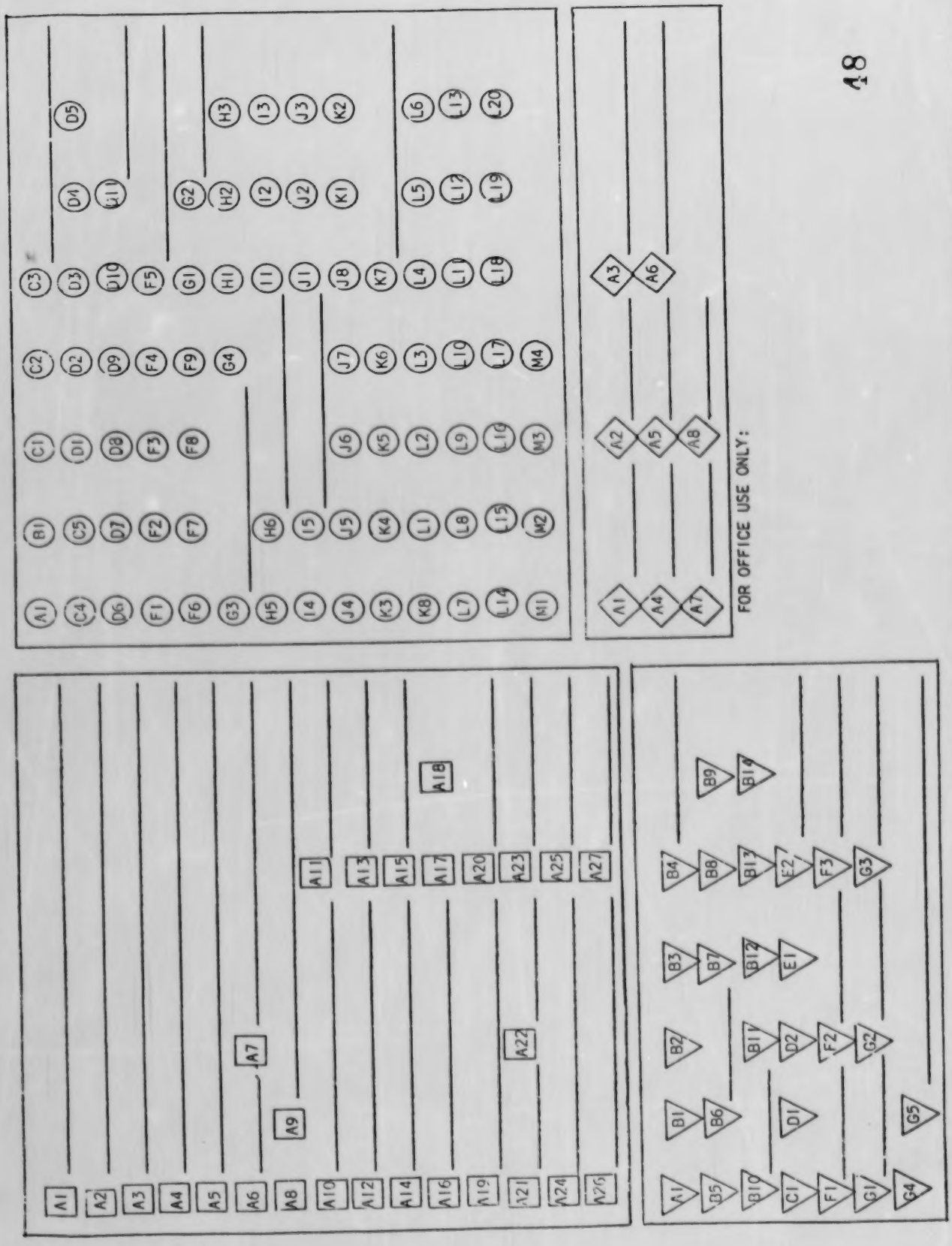
A Example of a Completed Descriptive Profile

The following entry illustrates the use of the system in describing an actual curriculum material item:

| | |
|---|---|
| Title: | Railways |
| Publisher: | De Saxe Studios<br>Melbourne, Victoria |
| Identification No: | (Call number of library) 385 RAI |
| Cost: | $9.75 |
| Location of item: | Ballarat C.A.E. |
| Medium: | 6 items of photographic pictures, purchased and packaged together, and packaged in a plastic envelope |
| Dimensions: | 30 x 27 cm |
| Contents: | Social science ; social studies ; Setting - Victoria, post 1955 ; pictures show predominently male subjects ; illustrates railway work ; thematic style ; index to set |

FIGURE 4

Curriculum Materials Descriptive Profile Record Pad



## THE FUTURE OF THE DESCRIPTIVE PROFILE PROJECT

The Curriculum Development Centre has decided not to fund the Project further. The information about curriculum materials which they intend to include in their Curriculum Information Service is minimal, and is similar to what may at present be found in existing lists and bibliographies of curriculum materials. However, recent developments in on-line retrieval systems in Australia - NUCAV and the AUSMAT J proposal for example - indicate that expertise exists outside of the Curriculum Development Centre for an on-line system for curriculum materials.

The Project team intends to test the system further in a series of workshops with representative user groups. The potential use of the system lies not only with curriculum materials at primary and secondary levels, but also at the tertiary level, and with specialised areas of education. If nothing else, the descriptive profile method could be used to produce annotations and synopses of uniform quality, as well as providing a structure for the analysis of curriculum materials in the training of teachers at all levels of education.

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NOTE: A full bibliography is given in the manual of the Descriptive Profile System. This brief list provides either bibliographic information or the address from which details may be obtained for a number of systems developed to analyse curriculum materials.

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# 'Gold' or 'Dust'? Instructional Technology in Higher Education

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## INTRODUCTION

This paper focuses on the impact of instructional technology on higher education. The question "gold" or "dust" is not for the purposes of rhetorical window-dressing. It suggests instead the dichotomy which exists amongst higher educationists with respect to the potentialities as well as limitations of instructional technology. Although it has been argued by Ellul (1964) and others that man is drowning in his own technological sea, in many respects it can be argued that any technology - whatever its intrinsic merits - can be virtually ignored, or at least under-used, by those people whom its major benefits have been principally designed to attract. Although one could test this theory against several possibilities, the writer has chosen instead to adopt a "micro" rather than "macro" viewpoint and to focus on the use of technology in higher education. Accordingly, in highlighting these potentialities as well as limitations, it is proposed briefly to define the nature and scope of instructional technology *per se*; more importantly to focus on the economic as well as pedagogic considerations relating to its use in higher education; the degree of responsiveness of educationists to adopt the new technology to enhance instruction; and lastly the inherent shortcomings latent within the technology itself which have inhibited, rather than encouraged, its more general application in higher education. The overall conclusion is that there is a continuing hiatus between the ideal and the real in terms of the adoption of instructional technology in higher education; or, in summary, a continuing hiatus between the views of proponents of the technology ("gold") and of those who remain critical of, or indifferent to, its supposed educational value ("dust").

These observations were based chiefly on the writer's experience during 1976/77 in California - in formal studies in educational technology, in actual visits to several media centres and in contacts with a number of media or instructional technology practitioners. It is suggested these overall concerns relate as much to Australian as to U.S. conditions.

## INSTRUCTIONAL TECHNOLOGY - NATURE AND SCOPE

A prime concern exists with respect to an actual - as well as adequate - definition of instructional technology. An ancillary consideration is to give some historical perspective to the promise ("gold"), as well as shortcomings ("dust"), of instructional technology to improve higher education.

### Historical Perspective

The overall development of instructional technology can be regarded not as a revolutionary process but as an evolutionary one. This is true not only for higher education but for other areas where instructional technology can be seen to have had impact. The history of the instructional technology movement has been well-documented in Taggart's (1975) excellent bibliography. In other writings (Saettler, 1968; Woolman, 1971; Finn, 1972; the Carnegie Commission on Higher Education, 1972), a dominant theme emerges: *Technical innovations have always had, and continue to have, some important influences on the development of educational*

*practices*. Educational systems over the centuries have, in fact, significantly borrowed from their technological environments. A new advance in technology (e.g. the goose-quill pen, the emergence of paper, the invention of printing and the book) has in each case contributed to profound changes in education. More recently, the Carnegie Commission (1972) and Norris (1977) have continued to extol the virtues of the "electronic revolution." The Report of the Presidential Commission on Instructional Technology (Tickton, 1970) was equally enthusiastic; this enthusiasm was translated, in both volumes, to a series of positive recommendations concerning its future applications. It is difficult to scan any issue of *Audiovisual Instruction, A V Communication Review (now Educational Communication and Technology Journal)*, or the *Educational Media Yearbook* without continuing references ("gold") on the future of instructional technology. It is appropriate at this time to attempt a more exact definition of the products as well as services which comprise "instructional technology."

Definition of Instructional Technology

In this rapidly-expanding field, a number of names have been adopted to describe the nature and content of instructional technology. Twyford's (1969) excellent overview has traced the historical modifications of the terminology. This follows the standard approach of other writers (Saettler, 1968; Tickton, 1970; Carnegie Commission, 1972; Armsey and Dahl, 1973). All of these writings with their differing interpretations reflect the viewpoint that, "Any definition of instructional technology must be subject to the concept held by the definer" (Saettler, 1968, p.1). In short the term *instructional technology* is used in a variety of ways. The field itself, moreover, is in a state of flux, and earlier definitions such as merely "audio-visual materials" appear now to be obsolete. It has also been suggested that there is an urgent need to adopt standardisation of the terminology (Chisholm, 1975; Ely, 1975). Lack of standardisation reflects what Finn saw in 1960 as a prime task of the proponents of the new technology, i.e. to overcome the failure of not developing, to that time, "a well-conceived point of view and a position or positions concerning technology in education..." (Finn, 1972). Failure to adopt such a well-conceived viewpoint would, as Finn saw it, prevent any significant impact of technology on education except in rather *ad hoc*, or spasmodic, applications. However, in the 1960's the convergence seems to have been on a "product" and "process" definition of instructional technology (Tickton, 1970; Ely, 1975). It is the one I adhere to in this paper. Let us examine the core elements.

In terms of "products," instructional technology refers to the most commonly-accepted "software" and "hardware" stemming from the "electronic revolution" earlier referred to. In that context, the pieces which make up instructional technology include television, films, overhead projectors, overhead transparencies, videotapes, audiotapes, computer-assisted instruction, and others. One could, of course, extend the shopping-list to include other variants of the new technological formats. But this has been amply covered elsewhere in such standard listings as those of the Carnegie Commission (1972) and Brown (1973; Brown *et al.*, 1972). Perhaps more important at this point is to consider the "process" of instructional technology, which goes beyond any particular medium or device and focuses instead on how the media are to be used within the context of a learning system. In this context, it has been pointed out that: "...instructional technology is more than the sum of its parts. It is a systematic way of designing, carrying out, and evaluating, the total process of learning and teaching in terms of specific objectives based on research in human learning and communication, and employing a combination of human and non-human resources to bring about more effective instruction... ." (Tickton, 1970, Vol.I, p.1).

This "process" concept of instructional technology does seem to absorb the in-built competing elements of other definitions and resolves many of the other too-restrictive, or too-narrow, approaches. It moreover

appears to be the definition most commonly accepted in the United States, according to contemporary educational thinking, a point emphasised elsewhere (Tickton, 1970; Carnegie Commission, 1972; Armsey and Dahl, 1973).

Fragmentation of Definition

However it would be a mistake to suggest that all educators agree on the above definition to the point where it will be translated into actual practice. The definition cannot hold when, from outside the field, "the search for greater specificity impels some to divide instructional technology into several components" (Armsey and Dahl, 1973, p.2). Moreover, with respect to translation into actual practice, the definition belongs overall - as we shall see - more to the future than to the present. Hence, use of technology is significantly restricted from the outset when its potential practitioners, or its potential users, cannot agree on what its precise uses should be.

At this point it will be useful to determine some of the attributes for "gold" which are often associated with the potential of instructional technology in higher education. Then its actual uses can be examined, and divergencies of opinion about its true value can be sought.

## INSTRUCTIONAL TECHNOLOGY - POTENTIAL FOR "GOLD"

### The Carnegie Commission on Higher Education

The "gold" potential for instructional technology in higher education has perhaps received no greater endorsement than that of the Carnegie Commission on Higher Education. Reference can be made to its 1972 Report *The Fourth Revolution* in order to gauge some of the enthusiastic predictions with respect to the future of instructional technology. It is a regrettable fact that we know too little about the authors of this document to be able to infer some of their latent biases towards technology or even, for that matter, to gauge the objectivity of the report overall. However, on the face of it, the recommendations are balanced ones, and, at various points, are supported by statistical data. In any event some of the Commission's recommendations are indeed far-reaching. They perhaps also constitute a beacon for instructional technology planners in higher education over the next decade or so. There is no doubt that "in the field" the report was given an enthusiastic reception. In many respects the Carnegie Commission Report echoes the earlier findings and recommendations of the Presidential Commission on Instructional Technology (Tickton, 1970). Both works, coupled with the standard writings of such other authorities as Finn, Brown and Saettler, were found indispensable to formulate the recommendations which follow and I have thus drawn significantly on these sources.

The Carnegie Commission is un-equivocal in its conception of the future role of instructional technology in higher education. Enthusiastically, the Commission refers to the new technology as "the single greatest opportunity for academic change on and off campus" (p.1). Nor is it difficult to find the expression of similar sentiments elsewhere. In a recent issue of the *Phi Delta Kappan*, for example, Norris (1977) offers a six-page rationale for increasing use of "advancing technologies that have the power to revolutionize the quality, productivity, and availability of education" (p.451). Rather than sink reassuringly into other generalities of this kind, which are indeed replete in the literature, the obvious question can be asked: what, specifically, are the proposed advantages of using instructional technology, and to what extent can it serve as a much-needed change-agent in higher education? It is proposed to analyse these advantages. The analysis will focus on two main categories: pedagogic and economic. If the advantages are demonstrably sound, the reasonable assumption is that the new technology should have appeal to a wide audience - or should it?

Pedagogics and "Gold"

The most important likely benefits in this area can be claimed to be:

1. For Students

(a) An enrichment and improvement of the conditions in which human beings learn, stemming from -

(b) Freshness and vitality in both presentation and transmission of knowledge. Here, I believe, the potential for instructional technology to supplement, if not replace, traditional "talk and chalk" is particularly strong.

(c) Appeal to students of varying abilities through such technologies as programmed instruction, computer-assisted instruction and other self-paced learning aids

(d) Improvement in learning re-inforcement

(e) Greater variety of student presentation of what is being learned (particularly at the graduate level)

(f) Much greater adaptability in many course areas of instructional technology to individualised instruction

(g) In general, a richer variety of courses, methods of instruction, and learning resources available to all students

2. For Faculty

(a) Lessening of routine "technical" instruction and supplementing, perhaps even replacing, human teaching in such areas as languages, mathematics, the sciences; or at least freeing the instructor from many routine/technical teaching tasks in order to provide remedial or other assistance to individual students

(b) Improving teaching through the specification of initial learning objectives and the more precise evaluation of learning outcomes

(c) Developing a more stimulating learning environment, drawing on and extending some of the principles listed above as student benefits

Economics and "Gold"

In this area some claimed benefits of instructional technology are:

1. Pronounced reduction in instruction costs below levels of conventional methods alone (Tickton, 1970; Carnegie Commission, 1972; Norris, 1977).

2. Cost-effectiveness in the provision for what is likely to be (post-1980) much greater off-campus instruction through "packaged" and "visual" learning (e.g. Open University), with perhaps a significant cost trade-off with lesser capital investment in buildings and a greater investment in the technologies by which such learning will take place and be transmitted. Already imaginative use of instructional technology is occurring with greater "at home" and "on the air" learning experience. Lovallo (1975) estimates that by 1985, some 82 million adult Americans may be involved in formal education programmes outside the mainstream of traditional classroom settings. Similar predictions with respect to the greater role of independent study off campus, to which the varied resources of instructional technology could be fruitfully aligned, are given by the Carnegie Commission (1972).

3. Enhanced cost-effectiveness, not to mention greater user convenience in some respects, in many institutions through the centralisation of instructional and production services as opposed to the scattering and fragmentation of resources noted on most campuses. In California, the community colleges have taken the lead in centralisation either through the library or some form of resource

centre. How far have the Australian C.A.E.'s moved towards this goal? Should they? The writer would like to investigate this. Certainly, the newer U.S. colleges and universities seem to be favouring the Learning Resource Centre approach.

4. Perhaps most crucially, "Much of the expanding technology has the potential economic effect of spreading the benefits of investment in a single unit of instruction among very large numbers of students. It therefore has the ability to increase the productivity of higher education..." (Carnegie Commission, 1972, p.46). However, balanced against this promise, the short-run costs of establishing technological systems of instruction are likely to be very great (Carnegie Commission, 1972, p.45).

Summary of Pedagogical and Economic Benefits of Instructional Technology

Not all of the principles listed above are accepted with equal force. They represent a widening core of educational thinking. They can be significant variables, depending on the extent of their adoption, in the educational philosophy of individual tertiary institutions. However, two obvious questions logically follow from these principles. First, to what extent is instructional technology being used in higher education? Second, when the promise for "gold" has not been attempted, realised, or perhaps even believed, what are the reasons for non-use? For it will be obvious that here we are examining not only technology *per se*, but moreover the human values and perceptions which surround it.

## INSTRUCTIONAL TECHNOLOGY - ACTUAL USE IN HIGHER EDUCATION

### Actual Expenditure on and Extent of Use of Instructional Technology: Some American Data

It is difficult to find information on expenditure and levels of usage of instructional technology in higher education in Australia. However, some useful American data is available, and is given here as an indicator. Effort should be made to compile similar data in Australia. An enormous investment has already been made in experimentation and research in instructional technology in the U.S. - around $US 2.5 billion between 1966 and 1969 alone (Carnegie Commission, 1972). How much of this expenditure relates specifically to higher education? The Carnegie Report is not precise on that point. More recently, the ninth edition of *Audiovisual Market Place* (1979) reports an aggregate figure of $US 5.4 billion including direct sales of products and services, production costs, administration, and salaries. Here again, specific figures for instructional technology expenditures in higher education are hard to come by. However, earlier figures by Philos (1973) suggest that actual media purchases for colleges and universities, for 1972 at least, represented only 10% of total sales. Certainly, from either the Library or Learning Resource Centre, there appears to be a trend towards the provision of a wider range of learning materials as well as provision of services for the design and production of materials. At the same time, the general observation is made that awareness that instructional technology has a key educational role in teaching and learning is much more pronounced at the elementary, secondary and college (i.e. Junior College and Community College) levels than elsewhere.

The implication should be clear: less expenditure on, as well as fewer services and facilities for, instructional technology in higher education will inhibit its overall promotion, acceptance and use in that area. The barriers to change diffusion to win new advocates will also be obvious.

In examining the extent of use of instructional technology in America, reference can be made to the reports by the Carnegie Commission (1972) and by the Presidential Commission (Tickton, 1970). Both of these give, notwithstanding many of their enthusiastic predictions, a realistic picture of present use levels of instructional technology in higher education in the U.S. The Carnegie Commission, quoting 1967 studies by

Brown and Thornton, reported at the start of the 1970's that it was reasonable to assume that about 1000 colleges and universities were engaged in new media activities of some kind; that there was a variety of media uses "ranging from limited applications of a single medium to complex combinations" (p. 37); but that, on the whole (and this is highly significant) the adoption of instructional technology was largely *ad hoc* and advancing unsystematically in response to the enthusiasm and achievements of certain devoted practitioners. It is also interesting that a 1971 Massachusetts Institute of Technology study (cited in the Carnegie Report) of 90 technologists and 152 faculty representing a broad national cross-section of viewpoints referred to the adoption of instructional technology more in terms of the 1980's and 1990's than in the 1970's. This re-inforces the earlier predictions of the Presidential Commission (Tickton, 1970) that the wide-spread acceptance of instructional technology, as well as its actual implementation, were, for a variety of reasons, more for the future than for present needs.

Untapped Potential of Instructional Technology

In summary at this point, the "gold" potential of instructional technology is not yet sufficiently accepted or being applied with respect to higher education, notwithstanding the many attractions or perhaps inducements which the technology might be seen to offer by way of improved learning and improved teaching potential. Before examining the reasons for this, let it be emphasised that acceptance of the new technology and the willingness to experiment with its actual use are highly important. Acceptance and experimentation determine the extent to which the advantages of instructional technology, indeed also its inherent disadvantages, may be realistically demonstrated. There is also a danger that unless such acceptance and experimentation occur, instructional technology will remain in a pedagogical ivory-tower forever divorced from classroom realities and used by only its most devout adherents.

We should now explore in somewhat more detail the reasons for the non-acceptance and non-use of what should be for higher educationists prime technology.

## REASONS FOR VIEWING INSTRUCTIONAL TECHNOLOGY AS MORE "DUST" THAN "GOLD"

Reluctance of Users

It is perhaps axiomatic that "Old pedagogues do not easily learn new tricks." Whether one agrees with this statement or not, it is a logical place to begin, for it is undeniable that faculty attitudes towards instructional technology determine to a great extent its actual implementation in their teaching programmes. Let us consider one specific example: educational television. In the Carnegie Commission's (1972) findings, based on earlier surveys of faculty attitudes at a handful of U.S. universities, 50% or more of faculty in all cases were either neutral or unfavourably disposed towards the experimental use of instructional television in their teaching. These findings with respect to only one medium are, it is true, somewhat dated; but in this writer's opinion, from recent interviews of several media centre directors, librarians and faculty, the general reluctance on the part of faculty to use instructional technologies is still highly evident. True enough, the educational system has considerable inertia and tends to be change-resistant and, with respect to the use of instructional technology in higher education, generally unresponsive. But we must go beyond these generalities. Ancillary causes - those embedded in the nature of technology itself - should also be identified.



Low Status of Instructional Technology

The reasons for the low status of instructional technology in higher education are, according to Charles E. Silberman, Director of the Carnegie Study of Educators, "so intertwined that it is difficult to

separate them" (Tickton, 1970, Vol.I, p.77). We have to this point identified one recognisable element: faculty indifference or, at best, neutrality. Such attitudes determine directly how or when new technology will be used in teaching and, indirectly, how priorities, especially budgetary ones, will be set within individual institutions. But to return to Silberman's point, it is possible to isolate - as the Presidential Commission on Instructional Technology did in 1970 - some of the causes of the lack of impact of instructional technology in higher education. I want to list these caveats, along with an amalgam of other writers' viewpoints.

Several reasons for the low status of instructional technology are cited in the 1970 American Report of the Presidential Commission on Instructional Technology, including the following (Tickton, 1970):

1. Only a small fraction of university budgets is ever available for *any* form of instructional materials; the implications for instructional technology and other innovations are obvious. Most educational dollars within individual institutions are earmarked for staff salaries, new construction and maintenance. One might add here that for instructional materials, the over-riding tendency is still towards acquisition of print materials consistent with the teaching as well as research needs of major universities. Dr. Richard M. Dougherty, University Librarian, University of California at Berkeley, stated in an interview that it will be many years before such a vast orientation toward print materials will be reversed! How far should it be reversed?
2. Enlarging on the earlier point concerning faculty attitudes, one other attitude, perhaps not an unreasonable one in the Tofflerian age, is that technology has a dehumanising effect on education. These fears can be demonstrated to be groundless however if instructional technology makes the lecturer's role more effective through classroom support or through adjunct learning packages.
3. At many large universities, as Dougherty confirms, it is unreal to expect that faculty will necessarily be interested in devoting more time to teaching improvement and less time to research.
4. Many instructional technology programmes are of poor quality. "The majority of television lessons, instructional films, programmed texts, computer programmes for instruction are of poor quality, uninteresting, uninspiring and just plain tedious" (Tickton, 1970, p.79).
5. Instructional technology suffers from inadequate equipment, disappointing hardware, incompatability among equipment, and built-in obsolescence of equipment.
6. Needed hardware and software is simply inaccessible.
7. Faculty are not trained in instructional technology to exploit what is available.
8. Media specialists in colleges and universities are generally excluded from central planning and as a result their capacities to develop and implement new programmes to develop the necessary hardware and software are considerably impeded. This perpetuates the situation in which the majority of college and university courses are taught by traditional methods and without recourse to instructional technology for either instructional variation and/or instructional improvement.

Other Caveats

Several other sources of difficulties for instructional technology can be given in addition to those cited by the Presidential Commission, including the following:

1. Instructional technology has value only to the extent it actually assists learners in obtaining knowledge and skills. Traditional teaching will more likely be desirable in many situations, and instructional technology is, in fact, not designed to replace all forms of traditional instruction. Logic-

ally, instructional technology is merely one component in the total learning system involving instructor, learner, learning resources, and desired learning outcomes. However, in the literature there has been a strong tendency to "over sell" instructional technology.

2. Continual refinement is still needed as to the best guide lines and principles in the selection, organisation and use of instructional technology in higher education, and as to the learning methods, personnel and equipment to be applied.
3. Instructional technology in its initial stages of development is costing more, not less, than conventional educational practices (Carnegie Commission, 1972). Moreover, if it is to be used effectively, instructional technology may require (see studies cited by Carnegie Commission, p. 66) as much as three to seven times more preparation on the part of faculty than conventional lecturing.
4. Many studies have shown (Twyford, 1969) that the actual learning outcomes may not differ fundamentally irrespective of whether instructional technology is used or whether learning takes place via conventional teaching.
5. For the designer and administrator of instructional media, the present state of knowledge with regard to the design and integration of media into the instructional process, to accomplish specific instructional objectives, remains on the whole sketchy and inadequate (Allen, 1973a, 1973b; Clark, 1976).

## CONDITIONS FOR FUTURE SUCCESS OF INSTRUCTIONAL TECHNOLOGY IN HIGHER EDUCATION

As indicated in the previous section, there exist many reasons for the lack of impact of instructional technology in higher education. Even if we were to project our thinking to some ideal level of use, it may well be that, as the Carnegie Commission (1972) points out, it would be unrealistic before the end of the 1980's to expect much more than 20% of on-campus instruction to be delivered via instructional technology. However, even for the achievement of this somewhat modest level of application, a certain improvement, or rather certain improvements, will be necessary in many of the areas mentioned. Twyford's (1969) critical overview states that, present imperfections notwithstanding, "instruction utilising educational communications media and materials is generally effective and improvable" (p. 372). This would indicate that there is indeed fertile ground for the discovery of "gold." But "gold," as we know, rarely lies on the surface waiting to be picked up; it is a regrettable fact that one usually has to dig for it. In concluding this paper, that is the last ounce of value I hope to wring from that somewhat overworked metaphor. And, in so doing, I suggest the following as the most likely conditions of success to promote "gold" rather than "dust" for instructional technology:

1. Technology should be seen as the servant and not the master of education/instruction. It should not be adopted merely because it exists, or for the sake of educational "status." The Carnegie Commission (1972, p. 11) wisely sets the following criteria of when instructional technology should be used:
   (a) The teaching-learning task to be performed should be essential to the course of instruction to which it is applied.
   (b) The task to be performed could not be performed as well - if at all - for the students served without the technology contemplated.



2. As stated above, a generally recongised and agreed-upon need for instructional technology must exist. Or, as Schramm (quoted in Armsey and Dahl, 1973, p. 101) states, the probability of success will be greater if applications "grow out of a critical appraisal of needs and solutions." A desire to meet the needs, and to achieve this through the use of instructional technology, must pervade.

3. A purpose must guide the use of instructional technology, and must be articulated. If there are no clear purposes or objectives, it is highly likely that instructional technology will continue to be used in an *ad hoc* and unsystematic way.

4. Leadership must be exerted at the right level of authority in colleges and universities for the effective application and use of instructional technology.

5. Faculty must participate in, and support the development of, instructional technology to ensure its "legitimacy," acceptance, and actual use.

6. Continued refinement is necessary in measurements as well as evaluations of the learning experiences which are offered by instructional technology. In this I revert to Finn, who warns that as a basis for converting a movement into a profession, there must exist "an organized body of intellectual theory constantly expanding by research" (Finn, 1972, p. 63). According to Allen's (1973a) review, as each technological innovation has emerged, educators have sought to determine its utility and to compare effects of its use with existing modes of instruction. These effects have in the past often been minimal, irrelevant, or poorly-researched (Twyford, 1969).

7. There should also be continual improvement of hardware and software to avoid, indeed eliminate, some of the deficiencies mentioned previously.

8. Lastly, adequate resources - human, physical and financial - are necessary ingredients in the effective development and use of instructional technology in higher education. For without such resources, applications of technology must remain *ad hoc* and scattered within individual institutions, lacking both effective integration into the instructional programme and effective application to ensure appropriate learning outcomes. Greater reliance will have to be placed on such areas as instructional design and perhaps individualised instruction if media specialists are to have more than a technical or clerical role.

## CONCLUSION

The main purpose of this paper has been to demonstrate that for a variety of reasons - technical, human, fiscal, organisational, experimental and others - the mere existence of new technology does not automatically guarantee its acceptance and use. Aside from the latent imperfections in the technology itself, there are various other factors mentioned here which, to a large extent, dictate its actual degree of use. On the other hand, it is believed by this writer that instructional technology has a key role to play in higher education in Australia. True, the conclusions drawn relate mainly to American experiences, but the conditions of success are equally as large and challenging for theorists and practitioners in this country. And even if these conditions for success are only partially achieved, the likelihood of finding "gold" rather than "dust" will, it is suggested, be considerably enhanced for Australian instructional technologists.

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# In Support of Educational Technology : Some answers for our critics

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ABSTRACT

Many technological tools have now become standard components of educational practice. It must be acknowledged that many mistakes have been made with educational technology in the past, and this has led to some educators becoming critical of the role of technology in teaching/learning and even doubtful of its usefulness beyond being an interesting novelty. This paper discusses some of the major criticisms frequently leveled against educational technology and presents some answers to these criticisms which support the valid role of educational technology in enhancing human learning and fostering the development of individual interests and potential.

## INTRODUCTION

> "It has been claimed (Postman and Weingartner, 1969) that constant and accelerating change is the most striking characteristic of the world in which we live today, and that ours is the first human generation which is not likely to be governed by social traditions very similar to those of our predecessors. That ours is an era of rapid and radical techno-cultural change is a simple reality. Since the turn of the twentieth century, human society has undergone greater change than it had in the totality of its history up to that point, with a great deal of profound change occurring the few years since the end of World War II" (Ausburn, 1978, p. 12).

The developments in technology - especially communications and information processing technology - which are occurring in society in general are also becoming important parts of the education scene. The presence of technology in education is not uniformly popular. Educational systems generally tend to be slow to accept and adopt innovations of all sorts; whether because of wise caution, lack of resources, or plain stubbornness is often a matter for heated debate. In addition, there are those who specifically disapprove of the growing use of technological tools for teaching and learning. These critics level a variety of accusations at educational technology and technologists - accusations for which professionals in the field and those who believe in the value of technology in aiding human learning must have answers if we wish to maintain credibility and to contribute to the growth of sound utilisation of technology in teaching and learning.

Educational technologists are by now long past worrying about the question of whether or not technology should be a part of education. It is quite apparent that technology *is* rather well established in educational practice. The important questions which critics are asking and which educational technologists must be prepared to answer are concerned with issues such as the contributions beyond novelty and gagetry which technology can make to education, and the nature of the ends for which technology serves as a means. This paper discusses some of the major criticisms made of educational technology and some of the ways we can respond to our critics.

## "EDUCATIONAL TECHNOLOGY IS TOO HARDWARE-ORIENTED"

One criticism frequently leveled at educational technology is that it is too hardware-oriented and that much of the hardware purchased by schools is not used enough to justify its expense. It must be admitted that commercial producers have put the "hard sell" on education for their audiovisual equipment, and that many educators have been naive in the purchase of such equipment. As a result, a good deal of money has been wasted on instructional hardware which has failed to live up to its advertised promises and has been put away in closets to gather dust. American instructional development specialist Robert Diamond offers the following comments on the reasons for and consequences of poor implementation of new technology systems in education:

> "The reasons for these failures are many, but the major ones are consistent: overselling, unattainable promises, poor quality in the associated software, little evaluation, and, most significantly, each was introduced without the planning necessary for wise use and quality instruction. While some examples of excellent implementation of each approach can be found, there is little doubt that the abuses in the introduction of each not only limited their effectiveness, but also created barriers in the attitudes of many administrators and teachers that may never be overcome" (Diamond, 1979, p. 54).

The reason for the disillusionment and criticism of some for instructional hardware is understandable. In response, educational technologists can point out that much of the failure of hardware has been due not to failure of the hardware itself, but rather to *its improper and uninformed utilisation*. When *properly applied* with a sound understanding of its capabilities and a clear view of its role in the total educational process, hardware is a valuable means of serving many worthwhile educational ends, some of which will be discussed shortly.

In answer to the "hardware-oriented" criticism, educational technologists can also make it quite clear that we have set aside the naive belief that hardware is the solution to all educational problems and that hardware is not the only concern of the field we call educational technology. Two points may be useful here:

1. *Hardware systems are only one part of educational technology.* It has been pointed out many times that educational technology is an extremely broad field - at base a systematic approach to educational planning and to using all available resources to promote human learning. The breadth of the field is stressed in the ASET national constitution which defines educational technology as "the design, application, evaluation and development of systems, methods and materials to improve the process of human learning." Similarly, in its major document defining the professional field of educational technology, the Association for Educational Communications and Technology (AECT) in the United States speaks of the field in these terms:

> "*Educational technology* is a complex, integrated process involving people, procedures, ideas, devices, and organization, for analyzing problems and devising, implementing, evaluating, and managing solutions to those problems, involved in all aspects of human learning. In educational technology, the solutions to problems take the form of all the *Learning Resources* that are designed and/or selected and/or utilized to bring about learning; these resources are identified as Messages, People, Materials, Devices, Techniques, and Settings" (AECT, 1977, p. 1).

It is clearly the view of practicing professionals in educational technology that hardware is but one part of our field, and we need to make this known to our critics.

2. *Hardware depends on human input for its effectiveness.* Machines are delivery systems; that is, they are transmitters of information. They can carry information to learners with an extremely high degree of effficiency (Consider how many people are reached by television broadcasts) and effectiveness (Consider the emotional impact of many films). However, machines, whatever their information-delivery capabilities, are only useful if they have *something to deliver*. Hardware is dependent upon the programmes it transmits; and the programmes, in turn, are dependent on *human* input. *People* must decide what information is worth transmitting and must place that information in a form which is appropriate. Once human decisions, values

and skills have gone into the creation of effective programmes, then machines can deliver those programmes with great efficiency and impact.

Knowing that educational technologists are well aware that it is human effort, talent and values which are behind the effective use of hardware might help some critics feel less strongly that educational technology is purely a matter of machinery and equipment.

## "EDUCATIONAL TECHNOLOGY IS ONLY A GIMMICK"

Educational technology is often criticised as serving no really significant purpose in education. Some accuse it of being a gimmick, a novelty, a sort of electronic babysitter, or something to use "just because it's there." While it must be admitted that there are, unfortunately, some educators who use technological tools in these ways or who insist on sticking with the "gee whiz" approach to them, it can also be pointed out to the critics that educational technology has many significant and legitimate functions to perform in enhancing both the quality of instruction which can be offered to students and the number of students who can be served successfully. Among these functions are the following:

1. *Focusing student attention:* It is well known that attention to learning stimuli is necessary if learning and retention are to occur. The use of audio and visual materials aids in focusing the attention of learners on the messages which teachers wish to communicate. Several reasons can be suggested for the effectiveness of media materials in focusing attention. The simple psychological principle of the "orienting response" to novelty, variety, light, or motion offers one explanation. Another would be the simplification and delineation of a visual stimulus field which can be accomplished for learners through the use of such techniques as colour to separate specific details from background, or the use of progressive disclosure or overlay visuals to gradually build up a complex concept.

2. *Bringing experiences into classrooms which students could probably not have otherwise:* Teachers often would like to give their students an experience which is impossible for most of them to have in reality, or certainly impossible at the moment the teacher wishes it to occur. Visits to foreign countries to look at the cultures of others, witnessing natural or man-made disasters and their consequences, viewing important events in history, and seeing examples of the past achievements and life-styles of mankind would be examples of this kind of experiences. Through the use of such techniques as film and television in either documentary or dramatised mode, nearly any experience can be brought vicariously to students in highly realistic fashion.

3. *Preserving "once-off" events:* Many events occur, both inside schools themselves (e.g. a lecture by a visiting expert) and outside in the wider context of society (e.g. important news events) which can happen only once, but which will have educational significance for students who will come after. Such events can be captured and preserved for future use by means of technology.

4. *Making learning experiences more concrete:* The Piagetian concept of concrete versus formal operational levels of functioning in psychological development is well known. In learning new concepts, concrete rather than abstract learning stimuli are often far more condusive to understanding, even for learners who have generally reached the formal operational level. Edgar Dale has related instructional technology to Piagetian psychology by means of his "Cone of Experience" (Dale, 1969). He points out that all forms of vicarious experiences are more abstract than real ones. According to Dale, instructional methods can be placed on a continuum ranging from highly "real" or concrete (e.g. field trips or use of realia) to completely abstract (i.e. use of language only). Various audiovisual formats such as diagrams and charts, drawings, photographs, and film and video are shown as rungs on the ladder moving from abstract

to concrete experiences. Thus, technology can be used to aid learning by making it more concrete when necessary and appropriate.

5. *Adding affective impact to learning:* Just as technology can add concreteness to learning, it also adds impact. In fact, the two things are often related; impact often stems from the reality of images and sounds. A teacher can talk, for example, at great length and with great eloquence about the horrors of war or the beauties of Australia's wilderness areas. But a lecture will never have the emotional impact of a good film which presents the reality of sight and sound with colour, large screen, and dual speakers! The stimulation and motivation which stems from this kind of impact has learning implications which need hardly be belaboured.

6. *Visualising theoretical or unobservable processes:* It is often necessary for learners to gain understanding of processes which cannot be readily demonstrated or observed in reality because they are theoretical, occur naturally over a long period of time, occur naturally in too short a time, or occur naturally in a location which makes them invisible. Opportunity to see such processes would make them much easier to comprehend, and this opportunity can be provided through the use of such technologies as animation, time-lapse and slow-motion photography, and polarised overhead projection.

7. *Giving instruction uniform quality:* Every teacher has had the unhappy experience of having important information to impart to several groups of students and realising that the presentation given to some groups was not nearly as good as that given to others, and that some students were absent and missed the presentation entirely. Technology can help with this problem. A carefully prepared programme of information on video, tape/slide, etc., gives *all* students the teacher's best efforts. Play-back equipment does not need to "warm up" to its best performance, does not forget and leave things out, does not get bored by repetition, and does not suffer from performance-reducing fatigue or illness. A good media programme delivers the same high quality instruction time after time - *every time* - to every student, as many times as necessary.

8. *Providing efficient storage and retrieval of information:* As the volume of available information grows, increasingly greater amounts of time and space are required to catelogue, store and retrieve data. Developments such as computer technology, micro-forms and the video disc have important contributions to make in the field of information storage and retrieval by providing means of reducing both storage area requirements and time needed for retrieval.

9. *Providing simulated experience and realistic practice:* The value of giving students practice in performing the tasks they will encounter in their jobs is self-evident. In a wide range of subjects, such as teaching practice, medical diagnosis, administrative and management training, economics, engineering, and political science, the opportunity to learn through experience and "hands-on" practice in realistic situations is extremely valuable - vital, in fact, to the development of competence. There are, however, two major problems in providing such experience for students: (1) there is risk in giving inexperienced learners a free hand at experimenting in real settings such as schools, hospitals and businesses, and (2) real-life conditions are very difficult to simulate due to the presence of so many interacting variables and parameters. Technology - particularly computer technology - can offer significant assistance in this area. The capacity of computers for rapid manipulation of huge quantities of data virtually simultaneously allows the development of highly complex and realistic multivariate simulations which let students learn about interacting and conflicting factors and the consequences of various decisions and manipulations without placing actual people and resources at risk.

10. *Extending the distance range of education:* When instruction is confined to rooms in specially designated places and at specially designated times, there are large numbers of people who are unable to take advantage of the opportunity to learn. Agencies such as the Open University in Britain, departments of external studies or distance education in many schools, and extension studies branches of many organisations are helping to extend the availability of learning opportunities. Thanks to technology, distance education is no longer confined to the posting of print-medium communication between tutor and student. A wide range of materials in many formats can now be utilised in external learning packages. In addition, imaginative and sophisticated technology systems such telephone hook-ups, computer networks and small microprocessors for home use, talk-back television, satellite communication, and teleconferencing are now vastly extending the potential of distance education. Current literature in the field is full of numerous applications of technology which make distance education far more alive and personal than it has been in the past. The isolated student need no longer be the lonely or neglected student.

11. *Individualising and personalising instruction:* Individual learners have a wide range of abilities, interests, needs and learning style preferences. It is now generally acknowledged that technology can provide significant assistance in meeting the many needs of individual students. Resource-based multi-media programmes can offer teachers and students materials in a variety of formats for both independent and group use, and can provide such options as multiple levels of difficulty, alternative sequencing, and enrichment units. In addition, the record-keeping burden placed on teachers by individualised instruction can be relieved by the use of computer technology.

## "EDUCATIONAL TECHNOLOGY IS DE-HUMANISING AND INHUMANE"

There are several criticisms of educational technology which fall in the "dehumanising/inhumane" category. Technology has been accused of aiming to replace human teachers with machines, forcing teachers to adopt a mechanistic methodology, and promoting uniformity and conformity in both teachers and learners.

In answering the critics on these sorts of issues, it is useful to point out the essentially *neutral* character of technology itself. No technology serves any ends or takes on any character - either sinister or benevolent - until it is *used*; and the decision of what use to make of technology is a *human* decision. Technology does not decide what to do with itself; people make that decision. It is true that technological tools are powerful. It is also true that they can be utilised in impersonal and inhumane ways. It must be remembered, however, that they have an equally great capacity for constructive and humane applications, and human beings retain the right of decision to use technology in either way they choose.

Much of the anti-technology feelings in education can be traced to the rise in the 1960's of the Skinnerian school of behaviouristic technology. Not only did many teachers deplore the mechanistic character of programmed learning and teaching machines, but they felt resentment and threat from the research approaches which were used to validate the behaviourist technology. Ivor Davies of Indiana University makes the following analysis:

> "Operant conditioning, and the shaping of behaviour, became part of a radically new technology in education and, at the same time, generated a good deal of emotion for and against educational technology itself. A great deal of the initial effort, therefore, involved comparing the respective performance of classroom teachers and teaching machines in order to demonstrate the advantages of the new methodology. It was a similar technique to that still used in medicine and pharmacology, where a new procedure or drug is tested in a comparative situation, with one group given the new treatment and the other a placebo. The metaphor, in both instances, is that of a slotcar race, in which one car is raced against another in order to see who wins" (Davies, 1978, p. 22).

Another sour note struck by behaviourist technology which reverberated widely throughout education was Fred Keller's unfortunate choice of title for his famous article in which he introduced his system of instruction now known as the "Keller Plan" or "PSI" (Personalised System of Instruction). "Goodbye Teacher..." (Keller, 1968) was not a happy choice of words, for this title seemed to reinforce the belief that technologists felt that teachers could be dispensed with. That this was, in fact, not the meaning behind Keller's title becomes clear upon reading the article, but many misinterpretations occurred anyway.

Whether or not one personally advocates behaviourist psychology, one cannot overlook the fact that the historical association of educational technology with misunderstandings and misgivings arising from the behaviourist movement and the past research approach of pitting teacher against technology has had some unfortunate consequences in terms of creating negative and critical attitudes in teachers towards technology and its effects on their roles. However, it can be pointed out to critics that technology can be used to serve any ends and in accord with any psychological or philosophical viewpoint which teachers choose; the utilisation decision rests with them. Further, technology can be viewed not as a threat to teachers, but as their ally. By using technology, teachers can relieve themselves of many of their burdens of record-keeping, repetition, and dissemination of basic information. By allowing technology to assume such functions, teachers can be free to concentrate their time and effort on higher level activities such as analysing learning needs of individual students, planning instructional activities and experiences, selecting and producing a variety of learning resources, managing learning, consulting with individual students, and guiding student inquiry projects. This may indeed represent a change of roles for teachers, but the change has much in its favour.

Some critics feel that the use of technology in education creates uniformity and conformity among learners and a loss of individuality. To these people it can be pointed out that while it is true that technology can be used to produce uniformity, it also has tremendous potential for fostering diversity and catering for individual differences. Well-known advocate of ATI (aptitude-treatment-interaction) research, Richard Snow, points out that we have known about individual differences in school learning since classical times, but only in the past decade has research begun to show their real significance. Snow states that, "Until now, information about individual differences has been used in education primarily to select people *out*, that is, to reject college applicants, or to identify students needing slower or special education which often turns out to be no education at all" (Snow, 1978, p. 96).

In an age of technology, we can now go beyond identifying individual differences and beyond using them to "select people out" of a standard educational programme. With the assistance of technology, we can diversify education enormously. It is now possible to produce learning materials and plans to suit the needs of all kinds of learners, and to efficiently manage a multitude of simultaneous learning activities among students. The enormous benefits to students of an educational system with this capability need hardly be belaboured.

## CONCLUSION

Educational technologists need to know how to respond to our critics. This paper has looked at some of the concerns voiced by those who are critical of our field and at some answers to those concerns.

The ethical code for educational technologists espoused by AECT in the United States makes it clear that a *concerned professionalism* is a goal and responsibility for all practitioners in the field. Few would argue with the validity of this viewpoint. Demonstrating that we are *professional* in our knowledge and application of the technologies we advocate and *concerned* that the ends our technology serves are con-

structive and humane ones is a major responsibility of all educational technologists and a most helpful part of answering our critics.

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# Factors Contributing to Instructional Innovation in Higher Education : A Comparison of Australian and American Responses

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ABSTRACT

Higher education administrators have supported improvements in teaching by creating special funds to support selected projects. These projects have not been universally successful. This study was an attempt to locate factors contributing to successful instructional development projects. In a series of Australian projects, administrators, instructional designers and project directors were asked to complete the same questionnaire that had been used in the United States. Where the American respondents saw the issues as provision of support services, organisational support with good administrative systems, incentives for academic staff, and financial resources; the Australian respondents saw the major issues as provision of support and administrative services, status of the project inside and outside their institution, positive and clear innovative climate, and the academic staff member's expertise and skill to carry out the project.

## INTRODUCTION AND BACKGROUND

> "Most of the innovation that occurs could best be described as fiddling. Cummulative assessment is brought in here, open book examining there, a game or two somewhere else, TV, CAI, or carrels. These are healthy signs of dissatisfaction and uncertainty, but they tend to relieve the initiators of the need to face the fundamental re-appraisal of objectives, course design, assessment and outcome that experience suggests is both required and possible" (Wilson, 1973).

Innovation and change are fundamental to the process of instructional development, and in recent years administrators in higher education have supported curriculum improvements by funding selected projects. However, these projects have not been universally successful. Some projects have folded after the initial funding ceased or when the project director left for a new position; some have run into organisational and administrative problems that prevented them from ever starting.

In a review of research on curriculum and instructional innovation, Fullan and Pomfret (1977) established that the major emphases of the research have been on (1) the "adoption" decision before a change is implemented, and (2) monitoring the results of change. Recently, researchers have investigated the process of implementation and the environment required for innovation. Hall and Loucks (1977) have described their efforts to categorize the level of use of an innovation and thereby predict future stages of development. Lawrason and Hedberg (1978) have presented a model to predict instructional design success on the basis of institutional committment and personal expertise of the academic staff. This change in research focus can provide the instructional designer with an ordered array of factors that can be applied to the successful management of instructional innovations.

This article is based on a paper presented at the Research and Theory Division sessions of the annual convention of the Association for Educational Communications and Technology, New Orleans, Louisiana, U.S.A., March, 1979.

In commenting upon his experiences at two universities, Gropper (1977) advises the instructional designer to be sensitive to the bias, fears and misunderstanding on the part of the academic staff and administration unfamiliar with instructional design and change. The current modes of teaching and decision-making are firmly entrenched within the organisational structure. Innovation, if it is to occur, must be achieved subtly and gradually. Support for the project must therefore come from those helping to achieve the change. If the project is supported by the central instructional design, production and evaluation staff, then this will help the initial development of the project considerably, even if funds are not available to support major expenses. In fact, support staff, resources and rewards can be used to ensure the continuation of good projects. Gropper observed that a central facility with the specific expertise in instructional design, evaluation and production should be available centrally for the support of academic staff, and that the administration, academic boards and promotion committees should reward the effective teaching and curriculum design of academic staff participating in instructional design projects. While some administrators rewarded curriculum redesign efforts, by far the majority of projects surveyed in one study (Lawrason, 1977) did not have any central instructional design support.

Without support, what then act as incentives for instructional development? Spitzer (1977) asked academic staff in sixty institutions throughout the United States why they undertook instructional development projects. Spitzer found that indirect organisational incentives (administration committment, competent instructional development staff, etc.) were the most clearly developed and recognizable success factors. Direct incentives (payments, release time, etc.), recognition (letters of appreciation, titles, etc.), and personal satisfaction (achievement, striving for excellence, etc.) were of lesser importance and demonstrated less overall consistency in responses. The evidence of success of most projects, as Spitzer pointed out, was based upon intuitive rather than research evidence.

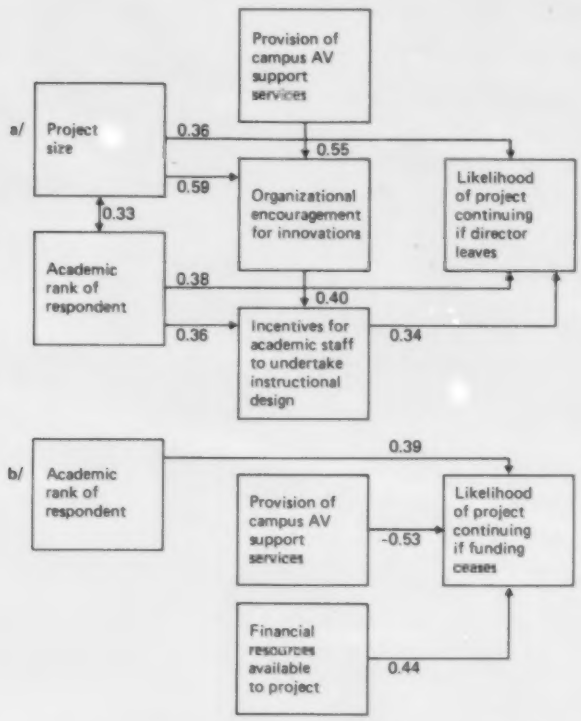
Lawrason and Hedberg (1977) identified the interrelations among key instructional design factors. From the instructional design literature they assembled a series of factors that were considered to contribute to project success. These factors (institutional committment, academic staff rewards, instructional design staff expertise, campus AV production services, programme evaluation and academic staff interest in innovation) were ranked by academic staff, administrators and instructional designers. While administrative committment to instructional development, primarily through financial support, was extremely important, respondents tended to group factors according to highly individualised concerns, and the factors perceived as contributing to success were related to the respondents' world view, and not to the respondents' academic or administrative positions. The groups of respondents so formed were characterised by their views on (1) administrative committment, (2) policies on curriculum change, and (3) personal satisfaction from undertaking the project. However, the respondents were asked to reply "in general" and no attempt was made to relate instructional development success to specific projects.

In a later study, also based on an American sample (Lawrason and Hedberg, 1978), respondents were asked to examine a *particular* instructional design project and comment on its success or failure and the factors that contributed to this outcome. The earlier factors were refined and further sub-divided to produce a questionnaire that examined five major areas in fifty questions. The five major areas were (1) the provision of instructional design and production support services, (2) the enthusiasm of the academic staff for change, (3) the provision of resources such as money and equipment, (4) the organisational climate that would hinder or facilitate innovations and changes, and (5) student interest in the project. One-third of the respondents indicated that their project was initiated by a member of the college administration and this fact alone was

instrumental in achieving a successful outcome. Under these conditions administrative committment was active and vigorous. Unfortunately, no clear distinction was made between directive and participative generation of the project, thus the role played by the administrator is not always clear. Four measures of project success were collected: (1) an overall estimation of project success, (2) the likelihood of the project continuing if funding ceases, (3) the likelihood of the project continuing if the project director leaves the institution, and (4) the effect of the project on student enrollments. Lawrason and Hedberg found that the likelihood of the project continuing if funding ceased or the director left were the only two of these measures predicted by the institutional and instructional design factors surrounding the project.

FIGURE 1

Factors that Predict Successful Instructional Projects
(Based on path diagrams, Lawrason & Hedberg, 1978)




The numbers on the paths are path weights. If a factor did not predict or was not predicted, it was omitted.

Figure 1 above shows results of a statistical analysis on Lawrason and Hedberg's 1978 study of American projects. In Figure 1 each important factor appears in a box. The arrow path implies that one factor affects another, and the weights on each path (which vary between 0-low and 1-high) indicate the strength of the effect. The overall estimation of project success was never negative, whereas the two likelihood-of-continuation measures appeared to be less positive and exhibited greater variability among the responses. This may be due to an inherent limitation of this type of study, i.e. the respondent was often the project director and initiator, which might indicate a degree of ego-involvement with the outcome.



## PURPOSE OF THE CURRENT STUDY

This new study sought to compare the factors which American and Australian academic staff felt were important to the success or failure of instructional design projects. As with the previous Lawrason and

Hedberg (1978) study, this comparative study is based upon the experience of academic staff who have tried to redesign a course and the factors they felt were important to the success or failure of their instructional project.

## METHOD

The respondents were administrators, project directors, academic staff and educational support staff in two Australian higher education institutions and six higher education institutions in the northeastern United States. After each project had been identified through educational research officers or through previous studies, the project director was called on the telephone and asked if he or she and co-workers would reply to the questionnaire. The questionnaire was structured into three sections. Part I identified the general nature of the project and the person responding. Data obtained in Part I included:

1. the title and objectives of the project
2. the size of the project
3. the academic rank and tenure of the respondent
4. the part played by the respondent in the project team
5. the rank of the person who initiated the project

Part II of the survey consisted of 50 questions (see Questionnaire, Appendix A) which measured the perceived importance of a wide range of items contributing to the outcome of an instructional design project. Respondents were asked to rate each of the 50 items on a scale of 1 (unimportant) to 7 (important). A set of *factors* (i.e., clusters of related items derived statistically) had been established with the United States data (Lawrason and Hedberg, 1978), and these factors[1] derived from the 50 questions were:

1. the importance of the relationship between the support staff and the project members
2. the financial incentives or intrinsic motivators available to faculty project members
3. the financial resources provided by the administration for the funding of the project
4. the importance of organisational facilitation, i.e. the interpersonal relationships between the administration and project members

Part III of the survey required respondents to rate the overall success of their project on the basis of four specific criteria, which were:

1. a global rating of the overall success of the project
2. the likelihood of project continuation after funds ceased
3. the likelihood of project continuation after project director left
4. the effect of the project upon student enrollments

These were rated on a similar seven-point scale (1 = low to 7 = high). The final two responses requested subjects to describe the "major factor which facilitated success" and the "major factor which limited success" of the project. On the basis of the previous study, it was expected that the relationships between factors would be as illustrated in Figure 1.

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[1]The Australian responses to the 50 questions were also analysed by factor analysis. As reported later in this paper, the factors produced by the Australian responses were different from those produced by the American responses. The factor structures for both groups were confirmed using the cluster analysis technique in the Veldman H-group programme. After establishing the factors for each group, scores for the composite factor variables were used in a standardised form in a regression analysis to determine path co-efficients for each group.

## RESULTS

The previous study was based upon 38 respondents representing 26 instructional development projects in American institutions. In this study this American group was compared with an Australian group comprising 27 respondents representing 22 projects. While some difficulty was experienced in identifying projects, an 82% response rate was achieved in the two Australian institutions which were surveyed.

The surveyed instructional projects were characterised by (1) the size of the project, (2) the respondent's academic rank, (3) the part the respondent played, and (4) the rank of the person who initiated the project. These data, for both the American and Australian groups, are shown in Table 1.

TABLE 1

The Nature of the Projects

| | | American Group (N = 38) | Australian Group (N = 27) |
|---|---|---|---|
| The size of the project | Smaller than a course | 5% | 23% |
| | One course | 13% | 27% |
| | More than one course | 82% | 38% |
| | General project related to teaching | 0% | 12% |
| The academic rank of the respondent | Senior administrator | 18% | 11% |
| | Departmental Chairperson | 11% | 15% |
| | Tenured academic staff | 55% | 63% |
| | Non-tenured academic staff | 13% | 7% |
| | Support staff (designers, educational technology specialists) | 3% | 4% |
| Part played by respondent in the project team | Project director | 58% | 67% |
| | Instructional designer | 8% | 18% |
| | General support | 29% | 11% |
| | Not a member of project team | 5% | 4% |
| Rank of person who initiated the project | Administrator | 58% | 11% |
| | Faculty | 39% | 81% |
| | Support staff | 3% | 8% |

*Significantly more academic staff initiated instructional projects in the Australian group, and correspondingly more administrators (deans, departmental chairpersons) initiated projects in the American group.* This may be due to differences in tenure percentages or the more fluid departmental administrative structure of American colleges. In the Australian institutions more staff were tenured, and the projects tended to be smaller units within a course rather than the larger multi-course restructuring common in the American projects.

*Some parallels were found between the two groups:*

1. Academic staff in both groups were predominately undertaking projects to develop their own course or courses.

2. Most respondents categorised themselves as departmental chairpersons or tenured academic staff. (It is possible that the lower frequency of untenured staff responses is due to their changing positions.)

3. The most common roles played by respondents were as project director and instructional designer.

Comparisons between the Australian and American groups were made on the 50 questions (see Appendix A) about project success factors. *The respondents in the Australian group considered the following aspects more important to project success than their American colleagues:*[2]

| Question Number | |
|---|---|
| 11 | Provision of administrative rewards (release time, money) for academic staff engaged in instructional projects |
| 16 | Need felt by academic staff to change existing course design and teaching strategies |
| 17 | Committment by academic staff to implement and evaluate the project as designed |
| 20 | Good personal relations between the members of the academic staff |
| 22 | Priority given by support service to full scale funded institutional projects |
| 26 | Efficiency of support systems |
| 27 | Positive and supportive attitudes of support service personnel |
| 28 | Good personal relations between academic staff and support staff on the project |
| 45 | Necessity to improve instruction for a specific disadvantaged student population |
| 46 | Large number of students to benefit from the project |

Some observations should be made about these results. The emphasis on academic staff (Questions 11, 16, 17, 20) is likely to be due to the rank of the person who initiated the project. More academic staff were responsible for project initiation in Australia, and this would increase the importance of responses directed at academic staff behaviours. American projects had a larger number of administrators initiating the projects. The Australian respondents saw instructional innovation as the development of media-based materials, whereas the American respondents were more concerned with restructuring the content. This would seem to be appropriately reflected in questions 22, 26, 27, and 28 which indicate the reliance of the project on media support services. The importance of the project to student learning either in terms of quality or quantity has often been used as a criteria for project funding in Australia, and this would explain the high rating of the two student-benefit questions (45 and 46). Reading the project descriptions supplied by each respondent, it appeared that Australian projects were more closely related to basic instructional problems, while the American projects appeared more to be derived from the respondents' research interests. However, the item relating to the importance of the project in generating research findings was not rated differently by the two groups: both rated it low (3.3) compared to other questions. *Only one item was considered more important by American respondents than Australian respondents,* namely question 36: self-support (budget) of project after initial development. The Australian projects often had institutional committment to carry the projects into regular funding. This was not always the case in the American projects.

The statistical grouping of Australian responses to the 50 questions into factors was compared to the factors previously determined for the American data. The only similarity in the factors was the continued grouping of questions 26, 27, and 28, which describe the efficiency of and relationship with the education support services. *With the Australian responses four factors were obtained which were characterised as:*

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[2]Simple t-tests for differences between means were applied, and 11 questions had t-values exceeding the probability of .05.

1. The importance of communication and support links between project director, administration and support staff personnel (Questions 5, 12, 23, 26, 27, 28, 49)

2. The status of the project and the director within and outside the institution (Questions 10, 15, 24, 30, 32, 39, 40, 41, 43, 50)

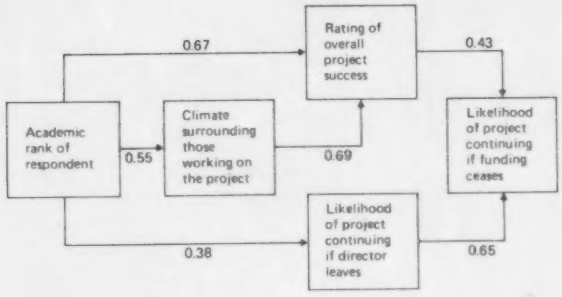
3. The climate or human relationships surrounding the academic staff working on the project, and their ability to be self-sufficient (Questions 3, 4, 19, 20, 35, 37, and 42 scored in reverse)

4. The instruction design expertise of the project director and the clarity of project goals (Questions 17, 21, 33, 34, 44)

*Of these factors, the ratings of the climate (Questions 3, 4, 19, 20, 35, 37, 42) were the major concern of the Australian group, and significantly predicted project success.* The path weights in Figure 2 represent the strength of the relationships between the factors. From Figure 2 it can be seen that the rank of the respondent affects (1) the overall success rating, (2) the climate rating of the project, and (3) the likelihood of the project continuing if the director left. On the surface this picture appears to be one of success, although the figure also implies that the project director, the climate and estimation of success are important precursors to project success where there are funding constraints. *If the director has competently created a self-sustaining project in a positive climate, then the project is likely to continue even without any special funding.*

FIGURE 2

Factors that Predict Successful Instructional Projects
Based upon an Australian Sample
(The numbers are path weights)




*Responses to the questions about overall success of each project did not differ significantly between the two groups.* In writing comments about their project most Australian directors emphasised the grass-roots nature of instructional innovation. While many worked as a member of a team, the projects were often self-styled with loosely defined structures. *By far the most important factor that helped the project was the co-operation received from the respondent's colleagues;* this was mentioned by two-thirds of the respondents. The remaining helpful factors were funding, positive student reaction, assistance of support staff, clear objectives and time. More serious was the list of *limiting factors.* One-third claimed there was a lack of departmental support and committment, and that funds were insufficient. Other limitations were delays, not enough people or not enough time. Two projects were hindered by the poor leadership and lack of expertise of the director.

## DISCUSSION

Of the Australian projects in this study, over half (59%) of the respondents were working on single course or small unit projects. This contrasts markedly with the American group where the majority of re-

spondents (82%) were working on projects larger than a single course. This pattern would seem to indicate different attitudes to instructional development and curriculum revision in the two countries. The Australian respondents were primarily working on their own projects, while American respondents often worked on projects initiated by another person.

Many projects generated large amounts of media-based individual study materials. In both groups the academic staff often undertook the development without an instructional design specialist to assist them. Support personnel were usually in a service role, providing graphics, recording a tape, or consulting on problem areas only. This exclusion of trained instructional design specialists resulted in some wasteful failures. Where specialists were available, the lack of good client relationships appeared to alienate the innovative academic staff; a few unfavourable comments were received about the slow response of the central support services. *An instructional designer could assist in these projects, but only if he or she gained acceptance as a team member and achieved harmonious relations with the academic staff.*

It is interesting to note that only one respondent in the two groups reported a lack of success. The respondent, a chairman of a department, cited the failure of the administration to inform the project director of the degree of funding for the project. The delay, which ran to three years, does seem excessive. Unlike the American group the overall rating of project success contributed as a major factor in the Australian study.

Lawrason and Hedberg (1978) found that "likelihood of continuation if funding ceases" and "likelihood of continuation if the director leaves" were the most important predictors of the successful project. In both groups these two measures appeared to provide best estimates of the "real" outcome of a project. Although the difference in likelihoods of continuance if the director left was not significantly different for the American and Australian groups, there was an indication that the American projects were somewhat more heavily dependent on their project director for a successful outcome than the Australian projects. Some similarities were to be expected, such as the importance of the academic rank of the respondent in predicting likelihood of project continuation if the director left. The more senior the respondent the higher the likelihood of continuing.

The Australian group did not produce the same set of factors (i.e., groups of related items on the questionnaire), nor did it confirm the previously determined factor relationship of the American group. The only overlap in grouping the questions into factors is the consistent grouping of support services, which were seen as relatively unimportant by both groups. The other factors in the Australian group emphasised human relations skills, expertise or competence and the standing of the project and director. The factors determined on the basis of the American data emphasised faculty incentives, project resources and administrative commitment, *all more external concerns than the more internal ego-involved questions that were considered by the Australian group.*

The model based on Australian projects (Figure 2) does concur with Spitzer (1977) when it emphasises that the *climate* surrounding the project is an important link in the prediction of project success. A number of other interesting relationships were indicated by the Australian data: the correlation between organisational support and the status of the project; and the joint prediction of instructional development expertise by the part the respondent played in the project and the size of the project. This last prediction path pointed out a rather damning relationship: the more important the part the respondent plays in the project and the larger its size, the less important instructional design expertise or competence is rated. Maybe it's simply a fact that large projects succeed in spite of the lack of expertise of the innovative academic staff associated with them.

## CONCLUSION

In considering the most essential factor influencing the success or failure of projects, it is interesting to note that academics place prime attention on the interest, co-operation and skills of the academic staff team members. *It is evedent that staff engaged in development projects place the burden of successful implementation upon themselves and their academic colleagues.* Over half of those responding (in both the Australian and American groups) to the question concerning "major factors contributing to success" mention the initiative or skills of the project director or other academic colleagues. Far fewer list administrative support, support services, or even funds.

*The comparisons made in this study should raise a note of caution to any researcher extrapolating the findinge of one successful innovation to predict outcomes in a different educational system.* Even though close cultural parallels exist in the two groups chosen for this study, differences have been noted in the degree of control over the environment of the project. Australian respondents were more concerned with academic staff behaviour, while American respondents were more concerned with institutional reward systems and the provision of resources. The results of this study might be considered a first approximation to the many factors in the institutional environment that affect instructional development. The importance of good interpersonal relations at all levels, mutually defined goals, and the supportive rather than directive role of the development specialist are essential.

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**Part II**



The following factors can contribute to the success of an educational development project within an institution Please rate the importance of each factor as you believe it contributed to the success of the educational project you have identified. Circle the number that most closely represents the importance

For example:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rapid provision of typed manuscripts | Unimportant | 1 | 2 | (3) | 4 | 5 | 6 | 7 | Important |
| 1 | Clearly defined organizational structure for decision making and implementation | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 2 | Small numbers of people involved in the decision making associated with the project | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 3 | Lack of competitiveness and possessiveness within existing academic departments | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 4 | Personal support of top administrators | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 5 | Provision of instructional project 'start-up' funds from operating budgets | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 6 | Continued budgetary support of administrators | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 7 | Administration concern for student enrolments | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 8 | Flexibility of administrators to integrate change into the administrative system | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 9 | Positive leadership skills of administrators | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 10 | Initiation of projects by administrators | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 11 | Provision of administrative rewards (e.g. release time, money) for academic staff engaged in instructional projects | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 12 | Direct communication between administration and academic staff | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 13 | Large number of people involved in the decision making associated with the project | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 14 | Initiation of projects by individual members of the academic staff | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 15 | Promotional considerations given to academic staff for work on projects | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 16 | Academic staff felt need to change existing course design or teaching strategies | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 17 | Commitment by academic staff to implement and evaluate project as designed | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 18 | Student positive feedback to academic staff on course design or improvement | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 19 | Openness and encouragement from department chairperson for instructional improvement | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 20 | Good personal relations between members of academic staff | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 21 | Experience of academic staff in course design, development and evaluation | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |
| 22 | Priority given by support services to full scale funded institutional projects | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Important |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 23 | Frequent communication between administration, academic staff, consultants, and support staff on progress of project | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 24 | Project planning actively involved input from academic staff, administration, instructional design consultants and other support services | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 25 | High quality of materials produced for project | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 26 | Efficiency of support services | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 27 | Positive and supportive attitudes of support service personnel | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 28 | Good personal relations between academic staff and support staff on the project | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 29 | Availability of professional consultants to assist with educational principles related to the design and evaluation of projects | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 30 | Diversity of technical support services, e.g. number of alternative media available, CAI, TV, audio, print, graphics, clerical, etc. | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 31 | Responsible position of project director in relation to institutional hierarchy | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 32 | Interpersonal skills of project director, e.g. accessibility, political acumen, team leadership, etc. | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 33 | Clarity of project objectives | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 34 | Initiation of projects by project director | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 35 | Attractiveness of teaching/learning techniques to potential students | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 36 | Self-support (budget) of project after initial development | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 37 | Attractiveness of subject matter to potential students | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 38 | Several academic staff members actively working on the development of the project | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 39 | One or two academic staff members actively working on the development of the project | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 40 | Potential of the project to generate educational research findings | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 41 | A number of publications generated by the project | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 42 | Availability of funds for project from external funding agencies | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 43 | Marketability of end product outside institution | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 44 | Instructional design skills of project director | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 45 | Necessity to improve instruction for a specific disadvantaged student population | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 46 | Large number of students to benefit from project | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 47 | Project reflects response to current social needs | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 48 | Formal evaluation of the instructional effectiveness of the project | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 49 | Good personal relations between project director and administration | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |
| 50 | Prestigious nature of the project throughout the institution | Unimportant | 1 | 2 | 3 | 4 | 5 | 6 | 7 Important |

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# An Overview of Human Characteristics of Potential Relevance to Instructional Design

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## INTRODUCTION

Human beings are bewilderingly complex creatures, possessing a large number of characteristics and tending to be highly differentiated within these characteristics. In confronting these complexities, educators frequently retreat into one or another defense position with regard to learners and their characteristics. One form of retreat, for example, is to concern one's self exclusively with a single dimension of human capability, disclaiming all others as being of negligible importance. Someone's theory regarding a single, albeit important, aspect of human functioning, is hailed and accepted by many as the answer. "True believer" retreats such as these are often quite noisy and, it seems, are sometimes a source of educational fadism. Another line of retreat with regard to learner characteristics is to give up on the whole thing in the presence of incomplete knowledge. This sort of retreat may be one source of a predisposition to educational "mushiness," in which semi-formed notions about the nature of learners and the art of teaching substitute for really trying to approach teaching and learning with a degree of precision and systematic inquiry.

There is at least one way to confront the complexities of human characteristics without retreating. This approach is to proceed in one's area of interest from the standpoint of concerned and searching eclecticism. Implicit in such a stance is a need for some conceptual framework. What is to follow represents the results of my own efforts at making some sense out of a wide range of work in human characteristics as they apply to instruction. A fairly simple conceptual scheme has emerged and is one which does seem to accomodate a good deal of what is known in this area in a way that clarifys some relationships and patterns of human characteristics which should be of concern to educators. Given the broad scope involved - broader, it seems than Bloom's (1976) recent work on a related topic - and given space limitations encountered here, no systematic attempt will be made to present state-of-the-art in all lines of work. Hopefully, however, what is presented will be sufficient to illustrate the framework being presented and certain posited relationships among lines of work used as illustration.

## A FRAMEWORK FOR HUMAN CHARACTERISTICS

At the outset, people should be viewed as having two kinds of characteristics. The first kind includes those in which human beings are more or less alike. Even though, in the final analysis, people are all different, we do share some attributes common to the species. Just as all leaves and snowflakes are different in detail, all leaves operate, in certain respects at least, in the same way; and all snowflakes are formed, in certain respects at least, in the same way. Something useful is learned about plants and weather when

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the search for differences and unique attributes is supplanted with a search for commonalities that shed light on what these things really are and how they might come to be. And so it has been with many aspects of the study of human characteristics. Important likenesses among people have been found which do not present themselves upon casual observation.

Another kind of characteristic includes ways in which people are different. The notion of individual differences is so pervasive in educational thought that little explanation or defense of the idea seems needed here. Suffice it to say that, while many differences between people are superficial and not too germane as guides for educational practice or as leads for research, other differences remain which should make a difference in educational practice.

Beyond likenesses and differences, a subdivision exists within both likeness and difference which should be considered. That subdivision refers to whether the characteristic in question tends to change over time or remain relatively stable. It goes without saying that as living things, people undergo constant change, but there remain characteristics - both of likeness and difference among people - that are more or less stable.

Four fundamental kinds of characteristics, than, are (a) likenesses among people which change over time, (b) likenesses which are stable, (c) differences among people which change over time, and (d) differences which are stable. Before illustrating each of these categories, a division along some sort of qualitative lines seems in order, in keeping with the fact that knowledge of some human characteristics is more important to educators and educational researchers than is knowledge of other characteristics. Given a relevance dimension, a rough distinction can be made between characteristics that are useful and those that are not useful as areas for study and educational development. Where to draw this line is a difficult proposition, particularly when exposition of a general framework is at stake. When drawing a line in examples to follow (see Figure 1), I do not claim access to absolute and universal powers of judgement. However, it is hoped that some patterns and illustrative general priorities emerge because, complex as learners are, one can not hope to pay equal attention to all of their characteristics all of the time.

## LIKENESSES

### Likenesses Which Change Over Time

There exist a number of physiological likenesses among people which change over time which have not seen any considerable wave of interest in educational research. An example of a characteristic of this sort can be seen in the newborn infant startle response. All newborn infants exhibit a particular sort of whole body, arm waving reflex when unweighted. The particulars of this reflex disappear in a short period of time, and probably form the neurological basis for a more localised response, i.e. surprise, which we keep for the rest of our lives.

More relevant characteristics of changing likeness can be seen in the dynamics of various development processes. People are continuously changing in their development, but the processes or dynamics of development are seen to be more or less the same for everyone. In other words, if a given developmental theory is valid, it will produce some degree of predictability of change in the capacities to which it addresses itself. Piaget's notions about how people come to acquire capabilities for certain kinds of abstract thought provide an example of a changing likeness (Inhelder and Piaget, 1958). This work has lent assistance to efforts at becoming more operational in specification of what is wanted in outcomes involving abstract thinking and can also be applied prescriptively in the specification of experiences to assist in achievement of these capacities.

FIGURE 1

Examples of Categories of Human Characteristics

## HUMAN CHARACTERISTICS

| RELEVANCE | LIKENESSES | | DIFFERENCES | |
|---|---|---|---|---|
| | change | stable | change | stable |
| NOT USEFUL | •Startle Response in Infants | •How Many . . . eyes, hands, etc.<br>•Response to Classical Cond. | •Looks<br>•Height, Weight, etc.<br>•Brute Strength | •Gender, Race<br>•Color of Eyes, Hair<br>•"Capacity of the Mind" |
| USEFUL | •Development processes . . .<br>·Intellectual<br>·Psychosocial<br>·Language | •Sensory Capacities<br>•Info. Processing<br>•Types of Learning<br>•Conditions of Learning | •Developmental state . . .<br>·Intellectual<br>·Psychosocial<br>·Language<br>•Prior Learning<br>•Prior Experience | •I.Q.<br>•Cognitive Styles<br>•Hemispheric Lateralization<br>•Locus of Control |

Other developmental theories are similarly illustrative of changing likenesses. The dynamics of various aspects of psychosocial and personality development have been variously treated by Freud, Maslow, Erikson, and others. In each case, the dynamics proposed offer insights into processes of individual "becoming." These processes are inextricable from any process or event of educational intervention, and can influence the interest or desirability of any action proposed. Like intellectual and psychosocial development, the dynamics of language development reflect a process of change which is in many respects the same for all people, no matter what person or language is in question, excepting only major disabilities. One view of language development which certainly underscores the likeness dimension is that of Noam Chomsky (1965) in which, broadly speaking, a propensity or "talent" for the structure of language is seen to be in a sense built into human brains to begin with. Changes which occur over time in facility and use of language are governed and enabled, one way or another, by common attributes which all persons possess.

Stable Likenesses

Heading a list of stable likenesses are physical configurations, both internal (as in where one's lungs are) and external (as in where one's ears are and how many one has). Typically, these factors have not tended to be high priority variables in instructional research and development. Even in the case of physical handicaps, people with a variety of them will perform no differently in most school work than those without, and will generally appreciate and benefit from this assumption, given equal access to facilities and programmes. Another sort of stable likeness can be seen in response to classical conditioning. As is widely

known but frequently misrepresented in fiction, classical or Pavlovian conditioning consists only of a stimulus substitution (Hilgard and Bower, 1965, pp. 48-76). For educators, at least, this sort of learning is learning only in a narrowly defined technical sense; Pavlov's dogs did not learn to do anything new, only to produce a pre-existing involuntary response to a substitute stimulus. Interest in phenomena of classical conditioning would appear to be almost entirely historical.

Stable likenesses among people which are generally more useful to educators include sensory capacities and perception. Although people vary in their eyesight, hearing, tactile sensitivity, and so forth, human sensory modality characteristics and phenomena of perception are more alike among people than they are different (Vernon, 1971). The human sense of smell, for example, is amazingly sensitive in one sense, but miserably crude and limited compared to that of a bloodhound. People are all alike in their inability to see beyond certain wavelength limits which define both ends of the "visible" spectrum. For the practitioner, knowledge of sensory and perceptual characteristics becomes important whenever an attempt is made to optimally involve the senses in teaching - which, I am tempted to submit, should be always. The success of various uses of audiovisual media, educational games, activity packages, and simulation trainers will often depend in large measure on their appropriate touch, brightness, visual detail, auditory characteristics, and so forth. The more ambitious one becomes in such treatments, the more critical a knowledge of perception and the characteristics of sense modalities tends to become.

Many aspects of human information processing are both stable characteristics and ones which are likenesses among people. Whether in capacity to make discreet judgements about a single stimulus (Miller, 1956), capacity for temporary storage of isolated, unmeaningful units of information (Miller, 1956), in processing multi-sensory simultaneous input as studied by Broadbent (1958), or in Paivio's (1971) work in encoding and memory of visual and verbal information, limits and capacities are found which do not appear to vary with intelligence, occupational preference, or even, as much as one might think, with age. The limits are real and are both confronted and abused daily in school work. But alternative and analogous capacities can provide ways around limits, capacities which can be called into play both in how material is presented and in how students can be helped in learning to get around the limits themselves. Furthermore, knowledge of information processing in cognition provides tools for learning task analysis which, among other things, allow prescriptions of content structure and sequence which help insure provision of the right experience at the right time (Snow, 1977).

Instances of stable likenesses among people which have theoretic interest and current utility can also be found within the study of human learning. Gagne's conception of types of learning provides an example. Gagne (1977) proposes that there are varieties of psychologically distinguishable types of learning (twelve, at latest count). Within any of these types of learning, the conditions for its achievement will be the same in principle for all people, without respect to age. The conditions required for rule learning, for example, will vary in detail between, say, a three-year-old person learning that "round things can roll" and a seventeen-year-old person learning a proposition in Boolean algebra. However, in each case a likeness exists in that prerequisite concepts must be learned and other general conditions must be met before the learning can take place.

## DIFFERENCES



### Differences Which Change Over Time

Among the many differences among people which change over time are physical features like height, weight, brute strength, looks, and so forth. It borders on the ironic that these most blatantly obvious, clearly

distinct differences are among the least useful for education. In the area of how a person looks, for example, it would be hard to defend the position that a pretty face (or the converse) does not tend to make a difference in how a person is treated, even in instances where it should not. However, that is not the sort of characteristic we can either do much with in teaching or even want to consider as teachers.

Developmental theories such as those noted earlier as examples of likenesses also deal with differences among people which change over time. Here, the viewpoint is not in terms of the *dynamics* of a process but in terms of the *states or stages of development* at which individuals may be seen to be operating. Typically, developmental stages are seen to be age-related but not age-bound, so there is a tendency to change or move upward in a developmental sequence, but the movement itself varies with each individual case and is not inevitable in any case.

An example of a developmental theory offering perspective on changing differences can be seen in the stages of intellectual development as identified by Piaget, which reflect a generally increasing capacity to engage in certain kinds of abstract thought. As is widely known, at the formal operations level, the individual can isolate and deal with interacting variables contained in abstract problems where such conditions exist. Research in intellectual development has demonstrated fairly clearly that a large proportion of adults, including tertiary students, have not achieved this frequently assumed capability, even though it is believed to be potential for practically everyone (Phillips, 1975, pp. 169-170).

Further instances of changing differences are found in the area of psychosocial development. Kirk Erikson's eight ages of man presents the view that as people grow older, they are predictably confronted with changing dilemmas and conflicts (Erikson, 1968). Dilemmas in each of these "ages" have slim chance of completely perfect resolution in a positive direction in any individual. Wide differences will be seen among individuals depending on what stage they are operating within and also among individuals within a stage based on particulars of prior and current experience. Erikson's ideas are but one example of a psychosocial theory which can be helpful in identifying and dealing with real and approachable difficulties experienced by students and other people at any age. Also noteworthy, and perhaps equally needed, is the contribution which a deeply humane view like Erikson's can provide in developing an empathic understanding of the living persons with whom educators work.

The realm of prior learning represents a highly technical means of finding, tracking, and assisting the achievement of specific identified learnings, and as such it contains powerful tools. Since people differ and change continuously in terms of prior learning, the use of an appropriate learning task analysis scheme can provide a necessary basis for prescribing what a learner needs and does not need in the way of new material or experience to achieve a task at hand. Conceptual tools to enable such analysis and specification may be found, for example, in the work of Gagne (1977), Bloom (1956), and Merrill (1973), to name only a few.

To speak of prior experiences, particularly social experience, as a concept apart from either development or learning can get one into some difficulty, but such a concept seems to offer another useful perspective of changing differences. For example, Bandura's work in social learning (Bandura, 1969, 1974), investigating how we use other people as models, has deep-running implications for how teachers may influence learning through social experience.

Stable Differences

Factors such as gender, race, the colour of one's eyes and hair are real individual differences among people wich are extremely stable with minor exceptions seen in greying, balding, and sex change operations. Factors such as these are, historically at least, ones which paying a great deal of attention to seems to do

more harm than good. Yet other useful stable differences do exist. Some of the more useful ones are probably only stable in a relative sense. In any regard, for those factors which will be mentioned below, there remains an important tendency toward stability and a dogged resistance to predictable change through intervention, particularly among adolescents and adults.

Although it can not be denied that there are positive and beneficial uses for information gained about learners from intelligence tests, there are so many fables, fictions, misconceptions, and misuses of these instruments that the debunking and general "hatchet job" done on IQ in the mass media in recent years has probably been in order. Be that as it may, IQ is relatively stable, and there are differences among people in this characteristic, even though we may not always be certain what the differences mean (not to mention the test scores themselves).

Another relatively stable difference among people is found in the area of cognitive styles. A growing list of nonacademic learner variables includes factors being variously referred to as cognitive styles, cognitive controls, and perceptual styles. These factors deal with differences in the ways in which people receive and process information. Included are such factors as field independent/dependent cognitive styles (Witkin, *et al.*, 1977), impulsive/reflective cognitive tempos (Kagan, 1966), leveling/sharpening cognitive controls (Klein, 1951; Santostephano, 1964), and visual/haptic perceptual styles (Lowenfeld and Brittain, 1970). From among the thousands of studies investigating cognitive styles, there is increasing evidence that they have a real impact on what kind of instruction different learners might benefit from most.

A final example of stable differences can be found in the study of hemispheric lateralisation, i.e. the differential functioning of the two hemispheres of the brain (Galin and Ornstein, 1972; Levy, Trevarthen, and Sperry, 1972; Molfese, 1973; Zaidel and Sperry, 1973). Not only is there a "difference" in an internal sense, but there seem to be differences in direction and extent of lateralisation among people. Although there may be a good bit of noisy prosletising from some in this area, there seem to be neglected potentials for human development at stake and, if not tested prescriptions, at least some compelling inspirations for ways in which these potentials may be fostered. Education in a world such as ours which is rapidly changing, radically technical, and pervasively visual can, it seems, benefit from a fresh view of the brain and what it is capable of.

## IMPLICATIONS

Some generalisations can be drawn about the types of characteristics presented here. Characteristics under *likenesses*, both those that change and those that are stable, can and should be used in the design or planning of instruction which will be the same, in certain regards at least, for a group or a class. For general strategies, sequencing, and specific learning activities which are appropriately based on these factors, what will work for one person in a class or group will work for everyone. The specific approaches to planning for effective teaching and to the design of entire instructional systems which are based on understanding of development processes and types of learning, for example, are among the most powerful tools currently available for increasing the efficiency and effectiveness of instruction.

The area of *differences* among people which *change* contains factors which instructional designers can apply in prescribing instructional management structures and which will typically require a teacher's close attention for each individual student. Not only are there differences among students in these regards, but they also keep changing as time goes on. These changing differences, then, are the areas in which the need for individualisation becomes most clear. Furthermore, these are the *primary* factors that education and

training have an influence on. After a period of time, what schools do will have been, in retrospect, a contribution to each student's developmental state, prior learning, and social experience.

Finally, the area of *differences* among people which are *stable* is one of both danger and promise. Some progress is being made on the more flagrant discriminations based on race and gender, but other stable differences among people are little enough recognised or understood at present to make it very easy to wrong students in some subtle ways. This is often the case with IQ. Additionally, left-handedness, one product of difference in hemispheric lateralisation, has amazingly deep-running prejudices associated with it that one probably knows fully only if one is left-handed. And finally, persons with cognitive styles which differ from those which are associated with academic success in schools sometimes find themselves diagnosed with a handicap or disability when, in fact, the individual has a strong capability in an unusual area, and it is the instruction, not the learner, which is suffering from inadequacy.

## CONCLUSION

Human beings *are* complex creatures. Given the vast amount of information both known and yet to be uncovered about human functioning, it should be little wonder that both the researcher and the practitioner find it easy to get lost in the topic - each in his own way. However, it would seem that, while there may be countless factors to consider, there may be a relative few which should be of critical, primary concern to the teacher, instructional designer/developer, and, perhaps, the educational researcher. Without pretense of "covering everything," sixteen major areas of presumed relevance to educators were presented here, grouped into four categories. New instructional design approaches might be the products of systematic consideration of important factors within *all* of the four distinct kinds of learner characteristics in a given research and development effort. To restrict one's self to consideration of human characteristics of only one sort is unnecessary, and to attempt to deal with a variety of major characteristics is, I believe, both possible and fruitful.

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# BOOK REVIEWS

**INSTRUCTIONAL MESSAGE DESIGN: PRINCIPLES FROM THE BEHAVIORAL SCIENCES,** by Malcolm Fleming and W. Howard Levie. *Englewood Cliffs, New Jersey: Educational Technology Publications, 1978. 275 pages + author and subject indices. $US14.95*

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*Reviewed by Floyd B. Ausburn, Monash University*

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Only rarely does a book come along which is important, relevant, and interesting enough to merit being called "a classic." I believe that Fleming and Levie's book is worthy of this title.

The authors state that their purpose in their book is to narrow the gap between research and practice in instructional message design. They intend the book to serve as a guide for *all* professional educators who are involved in designing and creating instructional materials.

The basic question addressed by this book is how to select or create instruction which is effective. What Fleming and Levie have done is to apply to this question the body of information about how human beings learn which has been gained from research in the behavioural sciences. They have been extremely successful in this undertaking.

Four primary research areas have been stressed in the book: perception, memory, concept learning, and attitude change. From research in each of these areas, Fleming and Levie have drawn conclusions which can be applied in designing instruction for maximum effectiveness. They have concentrated on conclusions which are both directly relevant to instructional design and well established by empirical research evidence.

While the research evidence supporting the conclusions is amply documented and referenced for those readers who might wish to seek out primary sources of data, research skills are certainly *not required* of readers of this book. The authors have designed the book as a useful tool for the general audience of education professionals and have been highly successful in making it comprehensible to this general audience. Each conclusion drawn from research is stated as a principle written in *non-technical* language - numbered and printed in bold type. Following each principle is a short discussion and some examples of how it can be applied to the designing of instruction. Many principles, especially those dealing with perception, are also illustrated with visuals.

Much has been said about narrowing the gap between research and practice in education and about bringing research findings to educational practitioners in a form they can understand and make practical use of. Fleming and Levie have actually *done* precisely that. They have produced what is probably the only available concise summary of "what the research says" about human learning which is both readable by non-researchers and directly applicable to the designing of instruction. Previous alternatives for seeking behavioural science research which related to educational technology and instructional design have been traditional psychology texts and assorted journal articles, neither of which has been very satisfactory for a general audience. The former are usually very heavy reading, unintelligible to the non-specialist; the latter are widely scattered, difficult to locate, and often require sophisticated research and statistical knowledge to decipher. Fleming and Levie have at last compiled the research findings about learning into a set of concise guidelines which can be applied to the design of instruction by *anyone* given that task.

I believe that *Instructional Message Design* is a vital resource for all educational technology professionals who wish to advance beyond hands-on production skills. The book offers a sound and very readable grounding in principles of instructional design based on the findings of many years of research in how human beings learn.

**TELEVISION PRODUCTION: A VOCATIONAL APPROACH**, by Richard L. Williams. *Salt Lake City, Utah: Vision, Inc., 1976. 173 pages + Glossary of Television Terms and subject index. $9.95. (Available in Australia from: Production Planners (Australia), P.O. Box 288, Glen Waverley, Victoria, 3150)*

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*Reviewed by Jean Anne Leecohier, Salisbury College of Advanced Education*

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At first glance, *Television Production: A Vocational Approach* looks like the typical television production handbook. The aims of the book sound familiar: "To explain to a lay person enough about each major production topic so that the student would be able to begin work with television equipment." The book contains content usually found in books introducing television production. There is information about videotaping equipment and processes, the production crew, directing a television production and how to visualise a television message. Also, the way the information is presented is nothing new. Black-and-white photographs and/or diagrams accompany short descriptions of equipment and procedures. Cartoons introduce each chapter. And the book is clearly intended for people only interested in studio-based television production. No mention is made of portable videotaping equipment and procedures.

With so many television production books around, why should someone look at this one? The answer, I think, is that most of us read books not only for basic cognitive information, but also for practical information derived from the author's personal experience. This is, of course, what makes every book different.

According to the Preface, the author of this book, Richard Williams, has extensive personal experience in television production. He has worked in commercial, industrial and educational television production, and he has written more than 70 articles on the subject. Presumably, from this experience, the author has included in the book many snippets that should be very helpful to people beginning television production. For example, a list called the "Ten Steps Approach" suggests a sequence of procedures for a television director to follow during the last five minutes before a television programme is recorded. This list also includes the commands a studio director can use to co-ordinate his production crew - very useful information for a beginning television director. Similarly, a later chapter on pre-production planning outlines the life of a director during the last two weeks before a television production. A time-line is given describing the steps the director needs to take in researching, planning, scripting and producing the typical television programme. A third snippet worth mentioning is the chapter which describes a number of projects for television directors. These projects are practice drills aimed at helping beginning directors to mentally internalise the verbal commands and motor skills they will need to co-ordinate the people and equipment involved in a television production.

In some ways, the title of the book does not do the book justice. The title suggests that the book is very practical and intended only for beginners. But the book also includes some rather technical information of interest to experienced television producers as well.

One of the most interesting chapters to me, an experienced television producer with no technical background, is the chapter about the video signal itself. Technical terms, such as sync pulse, lag and waveform, are explained clearly, and well-illustrated with photographs and diagrams. There is also a chapter on how to design a small television studio based on a number of studies in studio design. Among other things, this chapter looks at such things as studio size and shape, floor and ceiling materials, lighting and accoustics. The chapter describing the kinds of electronic effects you can create on the screen with a special effects generator is one of the most complete I have seen. Wipes, split-screen and keyed effects are clearly explained with accompanying photographic examples.

All in all, anyone interested in studio-based television production should find something useful in this book. I think there is something in there for everyone.

**EDUCATIONAL TECHNOLOGY: DEFINITION AND GLOSSARY OF TERMS (VOLUMN 1)**, AECT Task Force on Definition and Terminology. *Washington, D.C.: Association for Educational Communications and Technology, 1977. 365 pages. $US21.95 (AECT Members) $US24.95 (Non-members)*

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*Reviewed by Meg French, Monash University*

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Educational technologists - who are we? What characterises our profession? Where are we going as a field? These are questions that the Association for Educational Communications and Technology (AECT) aims to answer through this publication.

This is a noteworthy and a controversial publication: noteworthy because it is a significant attempt to define a diverse, ever-changing field and the terminology common to it; controversial because of the very nature of such an undertaking. Educational technology is a complex and multi-dimensional field, and it is not surprising that this results in a variety of beliefs and opinions as to definition of the nature, purpose, and direction of the field. The AECT attempts to reconcile these differences in what is probably the most comprehensive available definition of the field. It represents at least 14 years' work by a task force which synthesised the thinking of prominent contributors from all areas of educational technology. The result is in two parts: Part A defines educational technology as a theory, a field and as a profession; Part B (the glossary) identifies and defines commonly used terms.

Part A: Definition of Educational Technology. Part A details what AECT has endorsed as its official definition of educational technology. The definition represents a complex concept, yet its presentation in 16 parts makes it easily analysed, understood and applied. The definition section is based on the assertion that educational technology is a more inclusive and integrative concept than other approaches, e.g. "audio visual instruction," "educational media," or "educational communications." However, it is pointed out that these approaches play important roles as integral parts of the total and systematic concept of educational technology. When reading Part A an obvious question arises: "How do I, and my concepts and beliefs, fit into the one used here?" Readers are encouraged to read this definition with this question in mind, and to be reassured that their areas of concern are not omitted from this concept of technology.

Chapters 2-10 clarify and expand the definitional summary presented in Chapter 1. In so doing, they present the whole new conceptual framework upon which it was based. In these chapters, educational technology is analysed in turn from the perspectives of a theory, a field, and a profession, with each providing a different viewpoint, and criteria with which to evaluate the validity of the definition. Furthermore, they develop the concept that "... the definition must show clearly how the field derives from, and relates to, the theoretical construct, and how the profession derives from and relates to the field" (page 19). As the writers point out, without such congruence the definition would be unusable.

When studying these chapters, the pioneering of James Finn and his influence upon the ideas presented becomes readily apparent. He is one who in the past has urged the self-analysis of educational technology as a profession, as exemplified by the choice of terminology, and the development of a stated purpose and

sound theoretical foundations. As early as 1953, Finn sketched in an often-quoted list the characteristics of a profession, implying criteria for what was then called the "audio visual field" if it hoped to become a profession. According to Finn, a profession has, at least, these characteristics:

1. an intellectual technique
2. an application of that technique to the practical affairs of man
3. a period of long training necessary before entering into the profession
4. an association of the members of the profession into a closely-knit group with high quality of communication between members
5. a series of standards and a statement of ethics which in enforced
6. an organised body of intellectual theory constantly expanding by research

It is interesting to analyse how Finn's characteristics have been developed and applied in the definitional section of the AECT publication. Certainly, the format has been adapted, but the message remains the same: that these characteristics represent the synthesis of theory (intellectual technique) and the visible, practical applications of a field in the development of a true profession. Thus Part A defines educational technology in terms of the integral relationships between the theory, the field, and the profession. Chapter 2 provides the overall requirements for defining each. Chapters 3 and 4 analyse the requirements for defining a theoretical construct from both the historical and current perspectives. The requirements for defining a field from both intellectual and practical viewpoints are dealt with in Chapters 5 and 6. Finally, Chapters 7-10 discuss requirements for defining a profession from the point of view of its commitments to certification and training of its members; the quality of its professional association(s) in terms of standards, ethics, leadership, and the quality of communication between members; and finally its societal context and relationship to other professions.

The definition of educational technology and its conceptual framework as presented in the AECT publication represents a significant attempt to provide the basis for unity of purpose and direction of its members, while at the same time allowing the degree of flexibility necessary to reflect the diversity of its members and the ever-changing concepts, terminology and definitions of this growing field.

Part B: The Glossary. AECT further supports this publication by officially endorsing the process used to develop and organise the glossary section. They define criteria used to determine inclusion of an item in terms of answering the following questions:

1. Would an educational technologist performing the function be likely to use the term?
2. Would an educational technologist not performing the function need to use the term to communicate with others who were performing the function?

"Yes" responses to these questions were included as terms in the glossary.

It is important to note that the glossary as originally published is not complete. It only includes terms related to production of learning resources, techniques, instructional design, equipment, research, theory, and evaluation. However, an extended glossary has just been published by AECT which includes terms relating to utilisation, settings, logistics, personnel, and management of learning resources. These omissions in the original volume are blamed on logistical constraints of availability of people, time and finance rather than upon philosophical preferences.

The terms included in this volume provide an excellent basis for meeting the needs of practitioners by improving communication not only within the field but also between educational technologists and professionals in related fields. Explanations are short, simply worded and designed to overcome the confusion often caused by jargon. Furthermore, clarity is improved by including both generally agreed upon definitions and some

alternatives where differences in interpretation are not easily resolved. The entries cite the source of the definitions and, where appropriate, point out differences between definitions and their theoretical perspectives. Citation of the author or source of the glossary definition provides the reader with the opportunity either to refer to the source for a more detailed explanation or to determine the credibility of the definition. If a term is omitted, the glossary may make reference to a specialised glossary of more definitive listings of terms or a more technical set of definitions of these terms.

The section on "Use of the Glossary" provides the reader with a very clear description of how to locate terms. A master alphabetical index of terms (with page numbers) is placed in the back of the text and includes cross references to aid in location of alternative and related terms. However, the arrangement of terms in the body of the glossary is by category lists rather than a purely alphabetical organisation. These category lists with relevant subcategories organise terms by topic or learning resource functions. This allows terms to be interpreted in context, reducing the need to cross-reference while better illustrating the similarities and differences between terms.

Summary. This publication represents AECT's current position based on the most accurate and complete knowledge currently available. It successfully supports the aim of its compilers by providing structure in the application of technology to education. There is an obvious need to provide such clarity within the educational community in order to reduce the inconsistencies and misunderstandings caused by jargon and lack of communication. In order that educational technology exemplify those characteristics of a viable and growing profession as espoused by Finn and accepted by AECT, a thorough analysis of the purpose and terminology of the field is imperative whether the reader agrees or disagrees with all inclusions.

This publication provides such an analysis from which emerges questions and ideas for the development of the field. AECT's *Educational Technology: Definition and Glossary of Terms (Volume I)* calls for comments and ideas to contribute to the revision process and thus to strengthen future editions via the collective input of those involved in educational technology. The synthesis of the diverse purposes, roles, functions and motivations of educational technologists remains an ongoing challenge, and this challenge is extended to the readers of this publication.

EDITOR'S NOTE: For other reviews of this important publication see *Educational Communication and Technology Journal (ECTJ)*, 1978, *26*(4), 365-375.

**INSTRUCTIONAL TECHNOLOGY: ITS NATURE AND USE,** by Walter A. Wittich and Charles F. Schuller. (Sixth Edition). *New York: Harper & Row, 1979. 325 pages + subject index. Price not available.*

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*Reviewed by Alex C. Millar, Toorak State College*

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The first impression that strikes the reader who is familiar with earlier Wittich and Schuller editions is that the writers and publisher have at last given their book a facelift through the addition of a little colour, the use of a hardback cover and an aesthetically more appealing print type. Such an impression would be confirmed were it not for the fact that the colour, like much of the content, appears to be superficial, for indeed the only colour to be found in the book is on the cover. The criticism of superficiality is not altogether justified, however, because apart from the section dealing with colour in illustrations,

the absence of colour doesn't seem to detract too much from the message, and so far as the superficiality of content is concerned, the book is intended to be used in conjunction with a separate publication entitled *Student Production Guide*. This wasn't available for review purposes, but one is inclined to believe that the student guide probably fills in the missing detail where superficiality appears to be a problem.

As Wilbur Schramm points out in the Foreward to the book, the first edition of Wittich and Schuller appeared back in 1953, and for the first 20 years of its life it was called *Audiovisual Materials*. In 1973, the fifth edition saw that title give way to inevitability, and the title was changed to *Instructional Technology*. To those concerned with semantics, reference to the authors' somewhat lengthy definition of instructional technology should be sufficient to re-assure that the term "educational technology" and its American counterpart are synonymous. What is disappointing, however, is that while instructional technology is defined (in the Preface), and while the first chapter contains a useful coverage of the rationale underlying the use of audio visual materials, little attention is given to *justifying* the notion of instructional technology, and to relating it to the "in" term of "instructional development," although the latter term is covered at some length in the first and last chapters.

One of the consistently good features of the Wittich and Schuller editions over the years has been the provision of a sound rationale for using audio visual materials. In the sixth edition this involves a brief analysis of the communication process, a summary of psychological barriers to communication and the enunciating of what is called "six tenets of learning." The communication barriers listed include verbalism, daydreaming, perceptual difficulties, physical discomfort, and an interesting phenomenon called "referent confusion." Generally, the value of audio visual materials in lessening these problems is convincingly argued. The six basic learning tenets are sound, and should be useful for both budding and experienced teachers, covering such widely accepted principles as the uniqueness of each learner; the fundamental importance for learning of perception and involvement; the need for lesson content, media and teaching strategies to be appropriate; and the exhortation that creativity is a goal of learning.

The organisation of the second half of the book is along reasonably conventional lines with a chapter being devoted to each of the major audio visual media and formats. However, the first five chapters do not conform to this pattern. The first chapter, headed "The Teacher and Instructional Technology," examines the case for the use of audio visual materials and introduces the concept of instructional development. Chapter two, "Teaching with Pictures and Graphics," commences with a useful introduction to visual literacy, while the title of the next chapter, "Three Diminsional Teaching Materials," is self-explanatory. The fourth chapter, "Community Study and Learning," is a commendable inclusion in a book of this kind and contains some valuable advice for planning and conducting educational studies in the wider community. Chapter five looks at the various techniques for displaying learning materials effectively.

Then come the five media chapters covering audio, still projection, motion pictures, television and a chapter on computers, simulations and games. Finally, attention is given to multi-media planning in general and instructional development in particular.

One of the obvious shortcomings of this book is the lack of attention to the important and complex question of media selection. This is a serious flaw and detracts considerably from a work which is obviously aimed at trainee teachers, who require not only ideas on media utilisation, but assistance in making media selection decisions. Unfortunately on this count, as well as on a number of others, Wittich and Schuller's book doesn't compare particularly favourably with their main competitor in the field.

Despite this judgement, it is appropriate to conclude by commending the authors firstly for the up-to-date nature of their coverage, secondly for practising what they are preaching by the use of objectives as chapter advance organisers, and finally for focussing on audio visual software and its uses rather than simply on the hardware.